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## RECENT DEVELOPMENTS IN THE METHODS OF RICE CULTIVATION IN INDIA

INDIA grows rice in 75 million acres out of the world total of 233 million acres and the production is 32 million tons of rough rice or paddy against a world total of 150 million tons. Among the largest rice-growing areas, Japan records the highest yield of nearly 3,200 lb. with an acreage of nearly 7.8 million acres. In China with an acreage of 47 million acres, the yield is 2,200 lb. while in India the yield is 913 lb.

### RICE IMPROVEMENT IN INDIA

The improvement work in rice was first started in India in the second decade of this century in Madras and Bengal and was followed in other States much later and the Indian Council of Agricultural Research from its inception in 1929 promoted this work by giving financial aid to the various rice schemes sponsored by the States. The improvement work consisted mainly in the evolution of higher yielding varieties by the methods of selection

and hybridization. There are now nearly 284 improved varieties suitable to the different climatic and soil conditions in India. These varieties on an average give about 10 per cent. more yield than the local varieties. Side by side with the improvement of varieties by breeding, extensive manurial experiments were also conducted in various rice-growing States. Though the investigations on the manurial requirements of rice crop have not been carried out on the same scale as in Japan, the results so far obtained lead to the general conclusion that the application of organic manures like green manure at the rate of 4,000-5,000 lb. per acre supplemented by artificial like ammonium sulphate and superphosphate 150 lb. each, give responses to the extent of 15-40 per cent. or more, depending upon the soil condition. In the field of experiments regarding improvement in cultural practices the very first recommenda-

tion of the Madras Department of Agriculture as early as 1918 is the thin sowing of paddy nurseries and economic planting. It was shown by experiments that thin sowing not only increased the yield but also contributed to a considerable saving of seed. The yields from various Rice Experimental Farms in India which have adopted these methods range from 2,000-4,000 lb. which is nearly two to four times the average yield in India. On the other hand, the average yield figure in India has not increased so far due to various reasons.

During the Conference of Agricultural Scientists held in New Delhi in 1949, the problem of low yield obtained in crops in India was discussed fully and it was pointed out that the most important contributing cause is the delay in cultural operations. There is generally deficiency of available bullock power and it was recommended that in areas with assured irrigation, transplanting should be done as this alone gives 20 per cent. more yield than when sown broadcast. It was also recommended that provision must be made in every locality for sufficient number of nurseries for raising seedlings of rice and their supply at transplanting time. The advice regarding the thin sowing of nursery should be imparted to cultivators. All effective methods so far known regarding cultural operations such as early ploughing, timely sowing and planting, irrigation and weeding should be brought home to the cultivator by oral and visual propaganda and through leaflets. Prizes and certificates should be given to the best farmers who produce good crops.

The encouragement given by the Government recently in the shape of substantial awards has resulted in some farmers producing record yield of 8,000-12,000 lb. per acre. There is, therefore, great scope for increasing the rice yields by adopting good cultivation practices, judicious manuring of fields with organic and inorganic fertilizers and the extensive use of the good seed of improved varieties. These experimental results have not been extensively utilised by the cultivators due to the want of adequate extension machinery in India.

#### RICE IN JAPAN

The attention of the Ministry was directed to the important features of rice cultivation in Japan which has recorded an average yield of 3,500 lb. per acre and an article on 'Features of Rice Work in Japan and How They Differ from Those in India' by Ramiah and Vachhani was contributed to the *Indian Farming* in 1950. This article aroused a lot of interest and a number of enquiries regarding this was answered by the

Central Rice Research Institute. Since its publication, it is gathered that this article had been reproduced in some journals in different States of India. In November 1952, issue of the *Farmer* issued by the Director of Publicity, Government of Bombay, an article on "Paddy Growing in the New Way" dealt with the results of work done in 1951 at the Agricultural School Farm at Kosabud near Gholwad and also at the Kora Gram Udyog Kendra at Borivili, near Bombay by following "the modified Japanese methods" to suit the local conditions. The Minister for Agriculture, Government of India, in his broadcast from the All-India Radio, Delhi, in January 1953, gave the details of the Japanese methods of rice cultivation which has given 4,000-6,000 lb. paddy per acre in the two farms mentioned above in Bombay and a lot of interest among the public and the Press has been roused about this new Japanese way of cultivation in rice. This enthusiasm, it is hoped, augurs well for the future of rice cultivation in this country.

The essential features of the Japanese method of cultivation are:

(1) *Seed-bed*.—Good nursery management for the production of strong and healthy seedlings. This is effected by bestowing proper care in the preparation of seed-bed, thin sowing and proper manuring. Importance is also given to sieve out strong well-filled seeds by using brine water. Preparation of the nursery beds is done generally before sowing. The land is ploughed to a depth of 3½" and 4½" after which the soil is cultivated and irrigated. The beds are approximately 3½' to 4' wide and the bed length varies with the seedling requirements. The beds are raised 2" to 3" above the field level to facilitate drainage. Mixed organic fertilisers are generally recommended for the seed-bed. Ammonium sulphate and other water-soluble fertilisers are thoroughly mixed with soil before the rice seeds are sown. Wood ashes are applied when the seedlings are about 1" in height. 2 lb. of nitrogen and 1 lb. each of  $P_2O_5$  and potash are applied per cent. The seed is sown at the rate of 2 lb. per cent. and 3·5 cents of such seed-bed is used for planting one acre of paddy field. The seed is sifted through a sieve and then the light seed is removed by soaking the seed in brine solution of specific gravity of 1·13. Then the seeds are washed and soaked in pure water and drained. Sprouted seeds are sown in the seed-bed area. The weeding of the seed-bed is another special feature. It is also recommended by the Government officials that the seed be treated with Uspulum, a mercuric fungicide to control seed-borne diseases.

(2) Preparation of Fields for Planting and Manuring.—The preparation of fields for planting is done thoroughly. Chinese vetch or soybeans are often grown for green manure. After the green manure crop has been cut and dried for two or three days it is ploughed under. Irrigation water is added to prevent the loss of nitrogen through aerobic bacterial activity. The amount of green manure crop harvested varies from 4,000-7,000 lb. per acre. The green manures are turned under about three weeks before the rice is transplanted to avoid the injurious effects caused by the decomposition products of fresh plant material. It is also the practice to supply 670 lb. of lime whenever green manures are used. It can be thus seen that the organic manures are applied to the land before actual puddling. Based upon the properties of the soil, the standard amount of manures and commercial fertilisers required to produce satisfactory yields has been determined for the various rice-growing regions of all the prefectures. The average amount of the three principal plant food elements applied are: nitrogen 80-100 lb. per acre; phosphate 60-80 lb. per acre; and potash 50-80 lb. per acre. Two-thirds of this manure mixture is applied as a sub-surface application in rice soils before letting in water for puddling, one-third is applied in two later applications, one about two to three weeks after planting and another two to three weeks before ear-emergence. Because of the shortage of fertilizers in recent years the farmers have attempted to increase the production of farmyard manures and a heavy dose of compost is applied to the field just before puddling.

Nearly 90 per cent. of the rice area in Japan is transplanted. The rows are usually 8"-12" apart, while the hills in the rows are between 3" and 8" apart. The spacing is determined by climate, soil fertility, amount of fertilizer applied and time of transplanting and variety. More seedlings are planted for low-tillering varieties or where tillering is low because of cool climate, infertile soil, lack of sufficient fertilizers or delayed transplanting.

(3) After Cultivation.—Inter-culturing is another important cultural operation done by a hand rotary weeder. This not only helps to bury the weeds but also helps in stirring the soil round about the roots and the fertilizer gets well mixed up with the soil which encourages tillering. The first interculturing is done 10-14 days after transplanting. It is repeated after intervals of about 10 days and stopped a week before the normal flowering

time. The standard depth of irrigation water is usually 1"-2". The fields are drained when the rice begins to ripen, i.e., when the heads start to turn down. Water is usually applied by canal but occasionally it is pumped from wells.

#### DISTINGUISHING FEATURES OF JAPANESE CULTIVATION

The striking differences between the methods of cultivation described above and the general cultivation practices recommended by the various Agricultural Departments in India are: (i) sieving of the seed and soaking of the same in brine water to remove the light and ill-filled seeds, (ii) heavy application of commercial fertilizers both for seed-bed as well as for transplanted fields, (iii) inter-cultivation for which the cultivator plants the crop in lines. The practice of sieving the seed is commendable, but a few experiments carried out in India show that yield from the crop raised from light seeds is not significantly different from that raised from healthy seeds. As a cultivation practice, it should be followed in view of better germination and good stand. Regarding the application of manures, it has been generally found in India that the yield response obtained from the application of more than 40 lb. of nitrogen is not remunerative and economic. When compared to Japan, where with high doses from 50-80 lb. nitrogen, the responses are of the magnitude of 20-30 lb. paddy for every lb. of nitrogen applied, in India on the other hand, there is a very low response of even less than 10 lb. of paddy for 1 lb. of nitrogen under such high doses. Even the favourable response obtained with doses of 20-40 lb. nitrogen is of the order of 15 lb. of paddy per 1 lb. of nitrogen. In most of the areas, the application of higher doses of nitrogen induces profuse vegetative growth resulting in the premature lodging of the crop and reduction in yields. The supply of ammonium sulphate in the country is also limited and even with the minimum recommended dose of 150 lb. per acre, a quantity of about 5 million tons of ammonium sulphate will roughly be required for 75 million acres of rice land alone. As it is, the schedule production both at Sindhri and Travancore, will not exceed more than 0.5 million tons a year. Realising this, the propaganda of the various Agricultural Departments is more towards growing green manure crops and the application of organic matter like compost supplemented by a moderate application of ammonium sulphate. Heavy doses of these artificials are not, therefore, insisted on, but stress is laid on the

application of compost and green manures. Interculturing of rice is probably a new one. This, perhaps, has a value in connection with the application of higher doses of nitrogen for getting better response. Further research on this aspect is needed.

India, like Japan, has enough technical information for increasing rice production in the country. In Japan, however, experimental results have been adopted quickly with the help of an efficient extension organisation. There is also an additional advantage of protected irrigation for over nearly 90 per cent. of rice area. There is a technician for every two or three square miles in Japan, while in India, the extension machinery has still to be strengthened.

As it is, we have now only one demonstrator in a taluk comprising several villages and, as such, personal contacts between the technician and the actual villager are few and far between. With the completion of the new irrigation projects which will supply more assured and timely irrigation water, and by popularising the intensive methods of rice cultivation and making the supplies of fertilizers and improved seeds available to the cultivators, rice production is bound to be substantially raised and the country made self-sufficient in her rice requirements.

N. PARTHASARATHY.

Central Rice Research Institute,  
Cuttack.

#### CENTRAL BUILDING RESEARCH INSTITUTE, ROORKEE

THE Central Building Research Institute, Roorkee, the eleventh in the chain of National Research Institutes to be set up under the auspices of the Council of Scientific and Industrial Research, was formally declared on 12th April this year by Maulana Abul Kalam Azad, Minister for Education and Natural Resources and Scientific Research, Government of India, and Vice-President of the C.S.I.R.

The establishment of this Institute was recommended in 1944 by the Building Research Committee set up by the C.S.I.R. As a start, a Building Research Unit was organised at Roorkee to work in co-operation with the Thomason College of Engineering, now the Technical University of Roorkee. As in the case of other national research institutions, research work did not wait for the erection of the Institute's buildings, but was started as early as 1947 in temporary quarters. The foundation-stone of the new building was laid in 1951 by the Hon'ble Shri Prakasa.

The Institute has been constructed on a site of 10 acres leased by the U.P. Government and the Roorkee University and an additional area of 57 acres has been acquired for further expansion. It consists of four blocks, the main block containing the Chemical and Physical Laboratories, the Technological Block housing the Soil Mechanics Laboratory and Workshops, the Library and the Museum Block and an Auditorium Block with a Lecture Hall having 250 seats. Very briefly, the Institute is dedicated to research which will step up the quality of building construction in India, while reduc-

ing its cost. To achieve this purpose, it will undertake surveys on building materials and construction on national scales and carry on research in building materials, methods of construction and the performance of buildings.

The problems for investigation in an Institute of this type are largely common to different countries, but there are some which are of special interest to India. The Institute will therefore pay special attention to problems like factors governing comfort and efficiency under tropical conditions, study of soil stabilization, use of indigenous materials, utilization of industrial wastes, construction of houses for persons of low income on an extensive scale, etc. The work of the Institute will deal with these problems under four main heads, viz., problems relating to (a) building materials, (b) methods of construction, (c) performance of buildings, and (d) survey and information. Mention may be made particularly of four typical problems whose satisfactory solution will have a great significance for the development of our building industry. They relate to improvement in the quality of bricks, the possible use of bamboo as a reinforcing material, investigation on novel methods of construction, evolved by the Institute itself or by others, pre-fabrication and assembling of building components, heat and sound insulation, resistance to moisture penetration, fire and weather, consideration of new architectural and structural designs and problems relating to brick industry, lime industry.

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**NEW LIGHT ON THE EARLY PHYLOGENY OF THE VASCULAR PLANTS  
AND ON THE INFLUENCE OF CYCLES OF PAST GLACIATION AND  
MOUNTAIN-BUILDING ON PLANT EVOLUTION\***

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Geological Survey of India, Calcutta

IN two recent papers<sup>1,2</sup> by the present authors and Mr. R. N. Shrivastava, several types of cutinised spores and tracheids of vascular plants from known Cambrian sediments in India were reported. These are of some importance as very few authentic remains of vascular plants are known from sediments earlier than the Middle Silurian. It was not suspected till recently that the vascular plants could have evolved as early as the Cambrian. As only to be expected, the spores recovered by us, most of them with well-developed tri-radiate marks, belong to the lower groups of vascular plants, namely, the primitive Pteridophytes and the Pteridospermae. The tracheids obtained are too fragmentary for reference to any particular group. But they all possess simple pits.

It is now fairly certain that vascular plants were evolved even as early as the Cambrian. A careful study of the spores indicates that for them to have reached this stage of development, the plants to which they belonged might have had a long period of evolution, most probably extending back even to the late Pre-Cambrian (? Proterozoic).

Spores and tracheids of vascular land plants were obtained from known horizons in the Middle and Upper Cambrian sediments of Kashmir, Spiti and the Salt Range.<sup>1</sup> Comparative study of these somewhat poorly preserved spores with those of the known younger Palaeozoic groups of plants cannot be considered satisfactory. Between the Middle and Upper Cambrian, and the Devonian or Carboniferous a long span of time had elapsed during which the earliest vascular plants should have undergone rapid evolution. But it would appear that the spores which are the reproductive elements, retained their essential distinctive features of the groups thus enabling us to suggest to a certain extent their possible affinities. From the study of these Middle and Upper Cambrian spores<sup>1</sup> we suspect that the representatives of the primitive Pteridophytes and the Pteridosperms had already been differentiated as distinct stocks at least by the Middle Cambrian time. The spores had already reached a fairly high stage of organisation including the development of rudimentary wings or bladders in

some. This surprising result induced us to look for the remnants of comparatively more primitive plant remains in earlier sediments.

Investigations were therefore extended to still earlier sediments than the Middle Cambrian, and from the upper part of the Lower Vindhyan, a horizon believed to be older than the Cambrians considered above, several well-preserved spores, possibly referable to the primitive Pteridophytes, and (?) the Pteridosperms were recovered.<sup>2</sup> The age of the Vindhyan is doubtful, but there is accumulating evidence that the Lower Vindhyan may be Lower Cambrian in age, if not older.

Amongst the Vindhyan spores believed to be Pteridophytic, we suspect the presence of those of the Psilopsida, Lycopida and (?)<sup>2</sup> the Sphenopsida. The Pteridosperms (of the Pteropsida) are also possibly represented. If our surmises are correct, we are inclined to put forward the tentative suggestion that the Psilopsida, Lycopida and (?) the Sphenopsida among the primitive Pteridophytes, and possibly even the Pteridosperms of the group Pteropsida had already developed as distinct lines of evolution even in the early Cambrian possibly getting back to the late Pre-Cambrian. It is not quite impossible that the Pteropsidan Cœnopteridales and Cordaitales might be traced in strata older than the Devonian.

The differentiation of these major primitive plant groups, i.e., the Psilopsida, the Lycopida and (?) the Sphenopsida, even in such early geological times seems to suggest that they had evolved probably along parallel lines from distinct ancestral stocks of higher Thallophytes or some form of "vascularised thallus" about which we can make very little surmises at present. The Pteridosperms of the group Pteropsida probably originated from the Psilopsidan stock very early in the Lower Cambrian, if not in the late Pre-Cambrian.

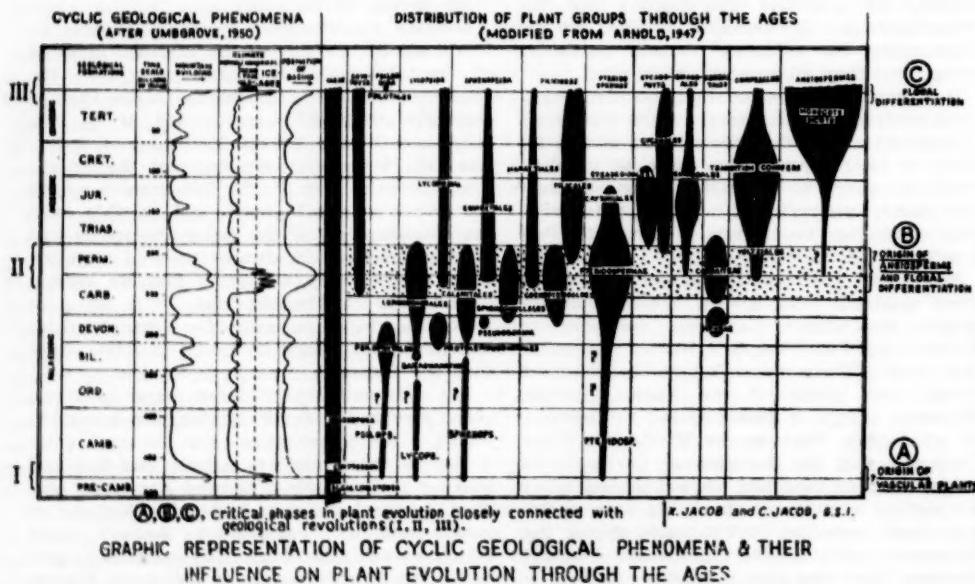
It is not quite certain whether or not the two lines of the main radiations in the Cormophyta, namely, the Stachyosporous (the Psilopsida, the Lycopida and the Sphenopsida) and the Phyllosporous (the Pteridosperm in part) groups were differentiated as early as the Lower Cambrian; for, at present, we are ignorant of the Pteridospermous spores obtained by us from the Lower Cambrian belong to Stachyosporous or Phyllosporous plants. The advanced groups

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of vascular plants of the Pteropsida (the Filicinae, the higher Gymnospermae and the Angiospermae) were probably derived in later geological periods from the major primitive groups mentioned above.

Elsewhere,<sup>3</sup> while discussing the origin of the Angiosperms, we put forward the tentative suggestion that the rigours of the late Carboniferous glaciation of the Southern Hemisphere and the other marked changes in environmental conditions brought about by the accompanying geological convulsions might have induced certain of the advanced Gymnosperms or Pteridosperms to protect their seeds more efficiently, thus giving rise to the first Angiosperms probably along more than one line of development. It may not be very unlikely that the first vascular plants too came into existence as a direct consequence of the extreme climatic conditions

In the left half of the accompanying Chart, the rhythmic geological phenomena are graphically represented (after Umbgrove<sup>4</sup>) and in the right half is shown the distribution of the plant groups in geological time (modified from Arnold<sup>5</sup>). From the Chart, the origin of the early land plants is apparently closely related to the geological revolutions of the late Pre-Cambrian (I, A, in Chart). Later in the late Palaeozoic, by which time several major groups of plants had been well differentiated, a very critical period in the history of the plant kingdom is remarkably exemplified in the Permo-Carboniferous (approximately between 212 and 250 million years), when the next cycle of major geological convulsions took place (II, B, in Chart). During this critical phase (stippled portion in Chart) certain large and established groups of plants were wiped out while others



GRAPHIC REPRESENTATION OF CYCLIC GEOLOGICAL PHENOMENA & THEIR INFLUENCE ON PLANT EVOLUTION THROUGH THE AGES

of the late Pre-Cambrian glaciation when, as in the late Carboniferous, the apparently cyclic processes of mountain-building, basin formation, regression of sea-level, magnetic extrusion (bringing about changes in  $\text{CO}_2$  available in the atmosphere), etc., were pronounced geological phenomena which too probably helped to accelerate evolutionary tendencies in organisms existing during that time (see in Chart I, A; II, B). Some of these phenomena were probably closely connected with the amount of solar energy reaching the earth.

came into existence. The origin of the Angiosperms or the flowering plants was also probably connected very closely with the major revolution of this period<sup>3</sup> (II, B, in Chart). Thus the two most vital steps in the evolutionary history of the plant kingdom, namely, first the advent of the vascular land plants (A, in Chart), and later of the flowering plants or Angiosperms (B, in Chart), may perhaps be considered to be the direct responses of the two major geological revolutions of the late Pre-Cambrian (I, in Chart) and the Permo-Carboniferous (II, in

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Chart) respectively, on the adaptive processes of the plant organisms. The Voltziales and other transition Conifers, the Ginkgoales, the Cycadales, the Bennettitales and the true ferns may be said to have evolved during the critical phase in the Permo-Carboniferous while the Lepidodendrales, the Calamariales, the Sphenophyllales and the Ctenopteridales faded out completely (II, B, in Chart).

The third major revolution (III, in Chart) which was initiated in the Pleistocene was mainly responsible in breaking up the more generalised floras into the complex pattern of plant association which exists to-day (III, C, in Chart). It was then that the second peak of floral differentiation (botanical provinces) took place, the first having occurred in the Permo-Carboniferous.<sup>7</sup> But it should be noted that the Pleistocene revolution which may be considered to be still in progress, "began far too recently for us to observe more than the beginnings of its effects on plant evolution".<sup>8</sup> Thus, except during these three phases of major geological revolutions (late Pre-Cambrian, Permo-Carboniferous and Pleistocene), evolution in the plant kingdom may be said to have progressed slowly during the intervening periods creating no spectacular changes probably because the hereditary characters of the germ cells remained comparatively stable in the absence of any

markedly violent environmental changes like extensive glaciation, large-scale mountain-building, regression of sea-level, etc. Such physical factors might have generally determined the basic patterns along which the plant kingdom developed through the ages.

It is indeed a fascinating suggestion put forward by Umbgrove<sup>7</sup> that the more or less equal intervals of about 250 million years between each of the three major revolutions and the accompanying spurt in plant evolution, probably represent the time required for a full rotation of our galactic system! It is becoming increasingly apparent that in order to make as complete an appreciation as possible of the factors that influenced organic evolution we shall have to look beyond the confines of the earth.

We are grateful to Dr. M. S. Krishnan, Director, Geological Survey of India, for his keen interest in the work.

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#### "JET STREAM" UNDER STUDY

**S**TUDIES recently completed by Dr. Vincent J. Schaefer, of the General Electric Company, U.S.A., show that winds in the "jet stream" blow at speeds ranging from 80 to more than 200 miles an hour at altitudes of 20,000' to 50,000'. These winds often double the speed of high-flying aircraft. It is found that the "jet stream" shifts about over the northern hemisphere as the seasons change. It moves often from south-west to north-east, but occasionally veers to the west, north-west or north. Sometimes two or more streams may be identified. In summer, the speed of the winds in the stream decreases to about half of the tremendous winter-time speeds.

Other indications of the proximity of the major axis of the stream include gusty winds at the ground level; persistent cool, crisp air; generally blue skies with visibility unlimited, and rapid changes in the amount of sky covered by clouds. When the "jet stream" is nearby, the coverage of the sky by clouds often changes from one-tenth of the sky to nine-tenths and back again in less than an hour.

Scientists believe that this air corridor may be responsible for many unusual weather con-

ditions for which there has previously not been any adequate explanation. Thus, for example, the stream can quickly carry extremely cold air from the north to warm southern areas and can convey tropical air masses to the north in the space of a few hours. Many floods, droughts and persistent hot and cold spells are also attributed to its influence.

In the past there has been no way to locate the "jet stream" quickly in order to warn aircraft or to study its probable effects on the weather. Dr. Schaefer's studies have now shown that its location and the direction of its winds could be determined by carefully co-ordinated observation of cloud formations by weather stations located in different parts of a country.

Four "specific and rather spectacular" cloud types are visual indicators of the location of the high-speed wind stream. There are cirrus streamers, high cirro-cumulus clouds, alto-cumulus and billowing alto-cumulus clouds that often extend from horizon to horizon, with parallel waves running at right angles to the direction of the air flow.

### RESEARCH COLLECTION OF MAMMALS

**A SURVEY** was carried out by the Bombay Natural History Society between 1911 to 1923 with a view to collect a series of carefully prepared and labelled skins and skulls of India, Pakistan, Burma and Ceylon for a critical study of their taxonomic status, variations and distributions. The survey was carried out by trained collectors, and a large collection, consisting of about 26,000 skins and as many skulls, was made at a cost of Rs. 1,80,000. The collection was then critically studied, identified, labelled and the more interesting groups or at least known groups reported upon by the experts at the British Museum, which greatly enhanced the value of the collection. In accordance with the conditions of an agreement between the Bombay Natural History Society and the British Museum, the latter selected 8159 specimens for their own collection and the rest has been lodged with the Society.

In view of the great scientific value of this collection to Indian Mammalogy and because of the great loss sustained by the national zoological collection during the flood of 1943 at Banaras, the Zoological Survey of India decided to obtain a representative set of specimens from the Mammal Survey Collection. In 1949, Dr. S. L. Hora, Director, Zoological Survey of India, on his way back from the U.S.A., visited the British Museum to examine this collection and discussed with the authorities of the British Museum the problems of its return to India. On his arrival in India, he impressed on the Bombay Natural History Society, the owner of the collection, the great value of the specimens lying in London and the urgency of their early removal to India. The Zoological Survey of

India offered to acquire a part of the collection and to pay for certain other contingent expenses. Thanks to the generosity of the Scindia Steam Navigation Company, the whole collection was brought to Bombay free of charge, though much had to be spent in verifying, listing and packing the specimens before its despatch from London.

On account of the great value of the collection, the Bombay Natural History Society was approached by some of the Governments of the countries surveyed and also by some foreign museums for the purchase of specimens. The Zoological Survey of India was, however, given the priority right and has obtained for the National Collection 3558 skins and an equal number of skulls, this being 20 per cent. of the total collection received from London. This percentage, was, however, restricted to the total number of specimens selected and the Survey was given freedom to select upto 40 per cent. from any group which was poorly represented in the National Collection. Such a basis for the division of the collection has tremendously increased the value of the share of the Zoological Survey for scientific research purposes.

The work of selecting specimens for the National Collection was entrusted to the Mammal Assistant, Shri. H. Khajuria. The specimens selected for the Zoological Survey of India include 408 forms, many of which are very rare and many are new to the National Collection. About 95 per cent. of the specimens selected had been collected from localities and in seasons which are unrepresented in the collection of the Survey.

### SIR LAWRENCE BRAGG

**T**HE managers of the Royal Institution have appointed Sir Lawrence Bragg, F.R.S., to the offices of Fullerian Professor of Chemistry, Resident Professor, and Director of the Institution's Laboratories. He will take up the duties

of the Fullerian Professorship immediately and the Laboratory and Resident duties on January 1, 1954. Sir Lawrence Bragg has been Cavendish Professor of Experimental Physics, Cambridge University, since 1938.

## PROF. JAMES W. McBAIN—OBITUARY

THE sudden passing away of Professor James W. McBain, formerly Director, National Chemical Laboratory of India, Poona, due to a heart attack on March 12, 1953, in California, will be received with deep regret both in India and abroad.

Prof. McBain was born on March 22, 1882, at Chatham, New Brunswick, Canada, and passed most of his boyhood at Port Dover, Ontario, Canada, and at Providence, Rhode Island, U.S.A. He obtained the degree of M.A. in 1904 from the University of Toronto and Ph.D. from the Universities of Leipzig and Heidelberg. He started his career as a Lecturer in Physical Chemistry at Bristol University, England. Honours came to him fast from all directions. In 1906, he was made Leverhulme Professor of Physical Chemistry in a chair created for him by the late Lord Leverhulme, in recognition of his fundamental researches on soap.

He was elected Fellow of the Royal Society in 1923 and offered the post of Professor of Chemistry at Stanford University, California, in 1926 and awarded the Davy Gold Medal of the Royal Society in 1929 for his pioneer and outstanding work on the physical properties of soap. He was starred in *American Men of Science* in 1933, elected Fellow of the New York Academy of Social Sciences in 1940 and of the California Academy of Sciences in 1946. He represented the United States at the Centenary of Mendelejeff at Leningrad, U.S.S.R. and flew round the world to attend the 220th Anniversary of the Academy of Sciences of Moscow.

He did a splendid job in training 1,300 officers of Cadet Battalions and captaining the Territorial Forces in the First World War for which his name was mentioned in despatches.

He had been Consultant on Research Committees of Colloids, Corrosion, Building Materials, Dental Materials, Adhesives and to the Oil Companies of California and Lever Brothers.

He was Chairman of Colloid Division, American Chemical Society, Vice-President of the Faraday Society, President of the Association of University Teachers of Great Britain, Guest of Honour at the Meeting of the International Union of Pure and Applied Chemistry at Cambridge, England, a Member of the Editorial Board of the *Journal of Physical Chemistry* and the *Journal of Colloid Science*.

Prof. McBain was a world authority on the colloid chemistry of soaps and published over 400 memoirs on various aspects of physical chemistry, notably those relating to the molecular structure of soap solutions, the McBain-Bakr sorption balance, which presents a simple quantitative method of determining surface areas and the simplest air-driven spin-top ultracentrifuge with photographic recording.

He is the author of two reference books, one entitled *The Sorption of Gases by Solids* and the other *Colloid Science* discussing with authority, insight and discrimination, fundamentals and important aspects of the subject. He delivered two of the Frontiers of Chemistry Lectures in 1943 which were published recently in the book entitled *Frontiers of Chemistry*.

The zeal and single-minded devotion with which he worked for the development of the National Chemical Laboratory of India, won him the esteem of his colleagues. He encouraged healthy criticism, original thinking, initiative and enterprise in every scientific worker. He showed keen interest in the social life of scientists working in the NCL and donated the McBain Colony Centre, housing the NCL Club and Co-operative Stores, on his 70th and last birthday on 22nd March 1952.

Prof. McBain is survived by his wife Dr. Mary Evelyn McBain, daughter Junet and son John McBain, to whom we offer our most sincere sympathy in their bereavement.

J. P. VARMA.

## IONOSPHERIC RECORDING

THE results of observations on the ionosphere carried out by the Radio Research Station, D.S.I.R., from 1930 to 1946 are now available in the form of a Report\* which discusses the results in general terms and describes the development of ionospheric recording in this country. It contains tables from which a particular range of observations can be chosen and explains how the detailed results can be obtained.

Regular ionospheric recording began at Slough in 1931. Since then, as knowledge and technique have grown, the scope and frequency of the measurements have been expanded. For the

past few years, the results of these measurements have been compiled in tables and circulated to the Post Office, the B.B.C., radio communication companies, shipping lines, airlines, scientists, engineers and others concerned with radio transmission. A large quantity of detailed material, however, has not been available before now except in small amounts and on special request.

\* Radio Research Special Report No. 23, available from H. M. Stationery Office, London, S.E. 1—Price 1s. 7½d. by post.

## LETTERS TO THE EDITOR

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THE C-C BONDS IN CYCLO-OCTA-TETRAENE  $C_8H_8$ 

THE nature of the C-C bonds in cyclo-octa-tetraene is a disputed question. Though the mean latent heat of vaporization, 9.8 K. calories/mole in the region 42-143° C. and the entropy of vaporization at boiling point 23.7 cal./deg. (Reppe<sup>1</sup>) and the resonance energy 25.3 K. cal. (Pink and Ubbelohde<sup>2</sup>), compare with the corresponding quantities 7.0, 19.73 and 39 respectively for benzene, the diamagnetic susceptibility<sup>2</sup> ( $-51.9 \times 10^{-6}$ ) accords with a cyclic system of conjugated double bonds. From the electron diffraction studies, Bastiansen and Hassel<sup>3,4</sup> state that though it was not possible to say that the C-C distances were exactly equal, their mean distance being 1.42, they were definitely not single and double bonds (symmetry  $D_{4d}$  or  $D_4$ ). Hedberg and Schomaker<sup>5</sup> finds them 1.33 and 1.45 Å and Karle<sup>6</sup> 1.35 and 1.50 (Symmetry  $D_{2d}$ ). But the latter states that there is

reasonable agreement with the radial distribution curves for one C-C distance 1.42 Å though the average displacement from equilibrium is slightly larger (1 Å).

From Raman and infra-red studies, Langseth<sup>3</sup> suggested a crown form  $D_{4d}$  with all equivalent bonds; Lippincott, Lord and McDonald<sup>7</sup> a crown form  $D_4$  with non-equivalent bonds, and Fleet, Cave, Vago and Thompson<sup>8</sup> a tub from  $D_{2d}$ . Saksena and Narain<sup>9,10</sup> calculated the C-C force constant for the structure  $D_{4d}$  as  $5.7 \times 10^5$  dynes/cm. but they were obliged to consider 1651 as a C-H frequency. They found, however, that the frequencies 194, 875 and 1651 cm.<sup>-1</sup> could represent the three polarised ring frequencies for the  $D_4$  structure though they remark that there was better agreement with observed frequencies for equal than for unequal values of C-C force constants.

We have revised the calculations of Saksena and Narain for the structure  $D_4$  (there appears

to be a small error in the calculations) and have made new calculations for the  $D_{2d}$  structure both for  $C_8H_8$  and  $C_8D_8$  molecules. The isotopic molecule was not considered by Saksena and Narain. We have calculated the three polarised ring frequencies belonging to the totally symmetric class for the two structures by considering CH a group of mass 13 and CD of mass 14. According to Lippincott, Lord and McDonald<sup>11</sup> there are six polarised frequencies 172 (10), 812 (4), 822 (9), 1636 (9), 1651 (10) and 2250 (10)  $\text{cm}^{-1}$  in  $C_8D_8$ . The last is a CD-stretching frequency and 1636 (9) and 1651 (10) represent a Fermi splitting due to the octave of 822. We, therefore, consider 172, 822, 1636-1651 as the three polarised ring frequencies in  $C_8D_8$  corresponding to 194, 875, 1651 in  $C_8H_8$ . Narain,<sup>12</sup> however, considers 811-822 as another Fermi splitting. For our calculations we have used the C-C distances as 1.34 and 1.54  $\text{\AA}$  and C-C-C angle as 125° for structure  $D_4$  and the distances as 1.33 and 1.45  $\text{\AA}$  and C-C-C angle 127° for structure  $D_{2d}$ .

The results are shown in Table I. It may

TABLE I

	$K_1 \times 10^{-2}$ dynes/cm.	$K_2 \times 10^{-2}$ dynes/cm.	$K_3 \times 10^{11}$ dynes-cm. radian	$C_8H_8$			$C_8D_8$		
				$\nu_1$	$\nu_2$	$\nu_3$	$\nu_1$	$\nu_2$	$\nu_3$
	9.0	4.3	.177	1691	799	198	1630	769	190
$D_4$	8.0	5.3	.177	1667	848	195	1606	816	187
	7.0	6.3	.177	1658	869	195	1597	836	187
	observed			1651	875	194	1636	822	172
							1651		
$D_{2d}$	9.0	5.0	.9	1737	815	194	1673	785	186
	8.0	6.0	.9	1721	849	194	1657	817	186
	7.0	7.0	.9	1716	861	194	1652	826	186
	6.5	6.5	.9	1651	831	194	1590	800	186

$K_1$  and  $K_2$  are the force constants of C-C valence and  $K_2$  of C-C-C deformation.

be seen that both  $\nu_1$  and  $\nu_2$  deviate most from the observed data for the values of C-C force constants corresponding to single and double bonds (9.0 and 4.5). It may be argued that these differences could be removed by using the interaction terms  $f_{12} \Delta r_1 \Delta r_2$  and  $g \Delta r \Delta \theta$  ( $f_{12}$  and  $g$  positive) in the potential energy function. Recent work on interaction force constants, however, shows (Coulson and Longuet Higgins<sup>13</sup>; Coulson, Duchesne and Manneback<sup>14</sup>; Duchesne<sup>15</sup>; Richardson and Wilson<sup>16</sup>) that these terms arise from three distinct causes: (1) resonance effects, (2) interaction between non-bonded atoms, and (3) changes of

hybridization. Since we are mainly concerned with the first of these, the interaction terms should be zero when the C-C force constants are those for a pure C=C and a pure C-C bond, viz., 9.0 and 4.5. Therefore, one should expect to find the best agreement between the observed and calculated values of frequencies in this case, but it is not so. This suggests, in agreement with the finding of Bastiansen and Hassel and the existence of resonance energy, that pure double and pure single bonds are not present in the molecule.

A complete study of the  $D_4$  and  $D_{2d}$  structures is in progress.

Dept. of Physics, B. D. SAKSENA.  
University of Allahabad, S. S. BHATNAGAR.  
February 1953.

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## RESOLVING POWER OF THE FABRY-PEROT ETALON

For the Fabry-Perot Etalon the intensity at any point of order  $n$  is given by<sup>1</sup>

$$I = I_0 / (1 + F \sin^2 \pi n) \quad (1)$$

where the symbols have the usual meanings.

Considering two spectral lines of equal intensity separated by an order  $\Delta n$  the maximum and minimum of the resultant intensity pattern are given by<sup>1</sup>

$$I_{\max} = I(n) + I(n + \Delta n)$$

$$I_{\min} = 2I(n + \Delta n/2).$$

Applying Abbe criterion of resolution, namely,

$I_{\min} = 0.981 I_{\max}$ , we get

$$\begin{aligned} & \{1 + F \sin^2(\pi \Delta n)\} \{1 + F \sin^2(\pi \Delta n/2)\} \\ & + \{1 + F \sin^2(\pi \Delta n/2)\} \\ & = (2/0.981) \{1 + F \sin^2(\pi \Delta n)\} \quad (2) \end{aligned}$$

Taking  $\sin(\pi \Delta n) = (\pi \Delta n)$  and  $\sin(\pi \Delta n/2) = \pi \Delta n/2$  to a first approximation, as was done by Meissner<sup>2</sup> and Candler<sup>3</sup> (for their calculations on Rayleigh and Sparrow criteria respectively), Eqn. (2) reduces to a quadratic in  $(\pi \Delta n)^2$ . The positive root is  $(\pi \Delta n)^2 = 2.2706$  F, giving

$$\Delta n = F^{-\frac{1}{2}}/2.085. \quad (3)$$

If  $n_0$  is the order of the central fringe, the resolving power is given by<sup>4</sup>

$$\lambda/d\lambda = n_0/\Delta n = 2.085 n_0 F^{\frac{1}{2}} \quad (4)$$

Similar calculations have been made on the Rayleigh<sup>2</sup> and Sparrow<sup>3</sup> criteria. The table below gives the resolving power of the prism, the grating and the Fabry Perot etalon, as calculated from the three main criteria.

TABLE I  
Resolving power of optical instruments

Instrument	Rayleigh's criterion	Sparrow's criterion	Abbe's criterion
Prism	$td\mu/d\lambda$	$1.26 td\mu/d\lambda$	$1.145 td\mu/d\lambda$
Grating	$N_n$	$1.26 N_n$	$1.145 N_n$
F.P. Etalon	$1.49 n_0 F^{\frac{1}{2}}$	$2.72 n_0 F^{\frac{1}{2}}$	$2.085 n_0 F^{\frac{1}{2}}$

The table is sufficient to stress the importance of Fabry-Perot Etalon as a means of deciding between these three criteria.

The author acknowledges thanks to Dr. K. Majumdar and Mr. Y. P. Varshni for their interest in the investigation.

Dept. of Physics, MAHENDRA SINGH SODHA,  
Allahabad University,  
Allahabad,  
February 4, 1953.

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#### ON THE ORIGIN OF ILMENITE PLACERS OF RATNAGIRI (BOMBAY)

During a short visit to the coastal area of the district, the author came across a number of placers of ilmenite and iron ore. The most important of these is at Malgund.

The area is covered by basalts and some dolerites. The microscopic studies show that the

traps have been subjected to metamorphism and that probably they represent the deeper flows in the Deccan traps. There is no reason to doubt that titanium is an ingredient of the basaltic magma. Plateau basalt contains about 2.6%  $TiO_2$ . When this magma intrudes granitic shell, or spreads on the surface, titanium crystallises in the form of ilmenite or as the high temperature titaniferous augite. Ilmenite is one of the earliest minerals to crystallise and, therefore, the simplest explanation of its origin in these rocks is that it is concentrated by crystal-settling and fractional crystallization. But this should give rise to universal occurrence of ilmenite in abundance in all the traps—which is not a fact. Though ilmenite is present in Deccan traps, it is only in this area that the concentration is rich enough to give rise to ilmenite placers. It seems more probable that the associated ilmenite has been brought here by three ways: (a) concentration of the early-formed crystals by crystal settling; (b) by accumulation of titanium and iron released from other minerals like augite, which are able to absorb as well as give out titanium under higher pressure temperature conditions; (c) by concentration of Ti, Fe, molecules and ions liberated from the higher zones, as these have a tendency to diffuse downwards.

Dept. of Geology, G. V. DAMLE.

Maharana Bhupal College,

Udaipur (Rajasthan),

February 26, 1953.

#### AN ADDITIVE FUNCTION OF CRITICAL CONSTANTS

RECENTLY several additive functions<sup>1</sup> depending on the physical constants, such as boiling points, have been proposed.

If  $T_c$  be the critical temperature and  $P_c$  the critical pressure, it is found that the function  $T_c^{\frac{2}{3}}/\sqrt{P_c}$  is additive for the normal paraffins. Taking the value of  $P_c$  in atmospheres, the additive function may be denoted by  $J$ , where

$$J = T_c^{\frac{2}{3}}/100 P_c^{\frac{1}{2}}.$$

The contributions of the component atoms can be evaluated and are given in Table I. The data are taken from standard sources.<sup>2</sup> It will be noticed that the differences for successive hydrocarbons is very nearly the same. The mean value of  $J$  for the addition of a  $(CH_2)$  group is found to be 89.8. The observed data are well fitted in the formula  $J_n = -58.9 + 89.8 n$ , where  $n$  is the number of carbon atoms.

TABLE I

No. of atoms	Paraffin	T <sub>c</sub> in °K.	P <sub>c</sub> in atm.	J observed	J calculated
1	Methane	190.7	45.8	53.75	50.7
2	Ethane	305.3	48.8	133.4	120.7
3	Propane	368.8	43	207.4	210.5
4	Butane	426.2	36	302.7	300.3
5	Pentane	470.4	33.04	385	390.1
6	Hexane	508	29.63	474.1	479.9
7	Heptane	540	26.89	562.4	569.7
8	Octane	569.4	24.66	652.9	659.5
9	Nonane	595.4	22.86	741.5	749.3
10	Decane	619.3	21.24	832.3	837.1
11	Undecane	642.6	19.92	925	928.9
12	Dodecane	663.8	18.59	1022	1018.7
13	Tridecane	683.2	17.55	1104	1108.5
14	Tetradecane	701	16.56	1208	1198.3
15	Pentadecane	717.6	15.75	1297	1288.1
16	Hexadecane	734.3	15.10	1387	1377.9
17	Heptadecane	749.3	14.41	1479	1467.7
18	Octadecane	763.2	13.83	1566	1557.5
19	Nonadecane	776	13.43	1644	1647.3

Excepting methane and ethane, the difference between the observed and calculated values of J is usually less than 1 per cent, which may be in some cases due to errors in critical temperature and pressure. The anomaly of methane and ethane is connected with the well-known fact that the lowest members of the organic series depart from the regular behaviour of the higher members.

If we substitute Van der Waals' values of T<sub>c</sub> and P<sub>c</sub>, viz., T<sub>c</sub> = 8a/27 bR and P<sub>c</sub> = a/27 b<sup>2</sup> in the J function, it is seen that a<sup>3/2</sup>/b is additive for the successive members of the normal paraffins.

The author is thankful to Dr. K. Majumdar and Dr. R. D. Tewari for their interest in the work.

Dept. of Physics, YATENDRA PAL VARSHNI, University of Allahabad, Allahabad,  
March 15, 1953.

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#### ULTRAVIOLET ABSORPTION SPECTRA OF MOLECULES CONTAINING SIX- AND FIVE-MEMBERED RINGS

In continuation of the previous work on the calculation of the electronic energy levels of indene,<sup>1</sup> the author has photographed the absorption spectra of indene, indole and thionaph-

thene (molecules possessing five- and six-membered rings) in vapour state and analysed them on the basis of the predicted allowed electronic transition A'-A'. In each molecule two distinct regions of absorption are observed. In indene there is a third region of continuous absorption at  $\nu$  44430. The first absorption region in each case consists of discrete bands. The position at which absorption sets in and the vibrational frequencies determined from the analysis of the bands are shown below for the three molecules.

Molecule	Onset of absorption	Excited state frequencies
Indene	$\nu$ 34729	357, 480, 807, 947, 1067, 1180 and 1344
Indole	$\nu$ 35235	478, 717, 906, 1313 and 1454
Thionaphthene	$\nu$ 34060	672, 736, 936, 1181 and 1331

The observational data and the discussion of the analysis will be published elsewhere.

Andhra University, Waltair, G. VISWANATH.  
March 23, 1953.

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#### SHAPE ANALYSIS OF QUARTZ GRAINS OF SOME SANDSTONES

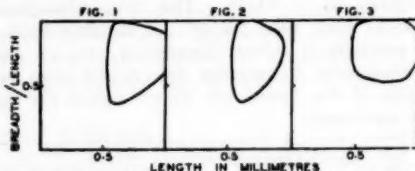
RITTENHOUSE<sup>1</sup> suggested the study of intercept sphericity in the elucidation of problems on the nature of sediments and their conditions of deposition. The three dimensions of a grain are determined and the shape value is derived from a chart using the breadth/length and flatness ratios. The apparatus in its simplest form consists of two glass plates with their flat surfaces held in contact at one end and wedged a measurable distance apart at the other end.

Shape values of quartz grains from three sandstones of Chintalapudi, Gollapalli and Rajahmundry formations in the Nuzvid area (Sheet No. 65 D/13) were calculated adopting this method. These values range as follows: Chintalapudi sandstones, 0.40-0.82; Gollapalli sandstones, 0.60-0.93; Rajahmundry sandstones, 0.63-1.00.

Scatter diagrams after Hagermann<sup>2</sup> are drawn for the three stratigraphic horizons with the length of the grain as abscissa and the ratio breadth/length as ordinate (Figs. 1, 2 & 3).

The significance of these results lies in that they afford some valuable confirmatory evidence of the nature of sediment and conditions

of deposition. The progressive and gradational increase in the shape values shows the partly re-worked nature of the younger sediments, namely, Gollapalli and Rajahmundry sandstones, an inference drawn on the basis of heavy mineral analysis.



Hagermann's diagrams for Chintalapudi and Gollapalli formations resemble each other in contrast to that of Rajahmundry sandstones. The essential similarity of conditions of deposition during the two stages of Gondwanas present here, and the striking difference in tertiary times are thus indicated.

My thanks are due to Professor C. Mahadevan, under whose helpful guidance this work was carried out.

Geology Dept.,  
Andhra University, Waltair,  
March 24, 1953.

B. B. G. SARMA.

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#### THE INCIDENCE OF THE Le<sup>a</sup> BLOOD GROUP ANTIGEN IN INDIANS

A POWERFUL anti-Le<sup>a</sup> serum was obtained from a routine blood donor of Group B. The antibody, which was active at 37° C., appeared to be of spontaneous rather than immune origin. The serum was tested by the tube method against the bloods of Indian adults of Groups B and O. The subjects tested did not constitute a distinct ethnological group. The results are shown in the table.

Group	Number tested	Number positive
B	100	28
O	100	29
Total	200	57 (28.5%)

The incidence of positives appears slightly higher than in England and Scandinavia, in which countries the average incidence of Le<sup>a</sup> positives is 22.04% (Race and Sanger, 1950).

As Le<sup>a</sup> positive blood in adults is genetically homozygous (Andresen, 1947), the gene fre-

quency of Le<sup>a</sup> in Indians calculated from the above results is  $\sqrt{0.2850} = 0.5339$ .

Blood Transfusion Dept., G. W. G. BIRD.  
Armed Forces Medical College,  
Poona, India,  
January 29, 1953.

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2. Race, R. R. and Sanger, R., *Blood Groups in Man*, Oxford, 1950.

#### A RAPID METHOD OF PHOTOMETRIC ANALYSIS OF VITAMIN B<sub>12</sub> IN CRUDE LIVER EXTRACTS

REICHSTEIN<sup>1</sup> had obtained a 90 per cent. yield of pure B<sub>12</sub> from liver extracts and streptomyces broth, using phenol-CHCl<sub>3</sub> extractions. Consequently this method was used to obtain vitamin B<sub>12</sub> in a concentration in which the purple colour of its dicyano-complex<sup>2</sup> can be measured.

30 ml. Whole Liver Extract, adjusted to pH 4.5, is treated 3 times with 10 ml. phenol-CHCl<sub>3</sub> (1 : 6). To the combined extracts excess of ether (100 ml.) is added and vitamin B<sub>12</sub> is shaken out 4 to 5 times with portions of 2 ml. water, adjusted to pH 2.5. To an aliquot part of the combined aqueous extracts, 1 ml. KCN (10 per cent. solution) is added and the depth in colour measured and compared against a standard graph, prepared at the same pH with known amounts of vitamin B<sub>12</sub>.

In the majority of 46 tests carried out so far the experimental error remained within 3 to 5 per cent. Recovery values of 50, 100 and 150 µg. crystalline B<sub>12</sub> (Merck.), added to 30 ml. of whole liver extracts were in good agreement with theoretical values. A proprietary product gave by this method in two trials on separate days 5.5 µg. B<sub>12</sub>, which is in good agreement with the theoretical value (6 µg.), considering that this batch is about one year old (15-3-1952). In preliminary comparative trials the results were also in good agreement with those obtained with the lead anaemia in the rabbit.<sup>3</sup>

Further work is in progress.

Research Dept., F. W. VAN KLAVEREN.  
Teddington Chemical D. BANERJI.  
Andheri, Bombay, P. C. SHRIVASTAVA.  
February 10, 1953. S. A. PATEL.

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**THE OCCURRENCE OF  $\gamma$ -AMINO BUTYRIC ACID AND GLUTAMIC ACID DECARBOXYLASE IN RED YEAST (*RHODOTORULA GLUTINIS*)**

In the course of our investigations on the amino acid composition of yeasts by Circular Paper Chromatography, it was found that the acid hydrolysate of a red yeast [identified by Centraalbureau Voor Schimmelcultures, Delft Holland as "*Rhodotorula glutinis* (Fres.) Harrison var. *rubescens* (Saito) Lodder"], gave a band in addition to tyrosine band between proline and valine bands when the chromatogram was run with *n*-butanol-acetic acid-water as solvent mixture. This band was identified as  $\gamma$ -amino butyric acid by spraying the chromatogram with sodium 1:2-naphthaquinone-4-sulphonate, which is a useful reagent for the identification of the amino acids as reported earlier by Giri and Nagabhushanam.<sup>1</sup> Its presence was further confirmed by running a mixed chromatogram with an authentic pure sample of  $\gamma$ -amino butyric acid (Nutritional and Biochemical Corporation, U.S.A.) and also by running two-dimensional chromatograms on large sheets of filter-paper using *n*-butanol-acetic acid-water as the first solvent and pyridine-water as the second solvent.<sup>2</sup> Although  $\gamma$ -amino butyric acid has recently been shown to be of widespread occurrence in plants, animal tissues, blood and urine, little is known of its occurrence in yeast, except the recently reported information on its occurrence in Difco yeast extract by Reed,<sup>3</sup> who stated that the pathway to such a metabolite has yet to be established in living cells other than bacteria.

Although it has been shown that  $\gamma$ -amino butyric acid is produced by the action of bacteria on glutamic acid, the occurrence of the enzyme, glutamic acid decarboxylase, has not been shown to be present in yeast. Reed suggested that this amino acid is a degradation product. This view is based on the observation that freshly harvested yeast did not contain the amino acid, while it occurred in free state in autolysates of yeast.

The occurrence of  $\gamma$ -amino butyric acid in the acid hydrolysates of red yeast led us to trace the pathway for such a metabolite and the enzyme system involved.

The organism was maintained on wort agar slants and periodically subcultured every week. The cell material for experimental use was obtained by growing it in a medium composed of glucose (2%), ammonium sulphate (2.5%), glutamic acid (0.5%),<sup>4</sup> salt solution (12.5 ml./100 ml.)\* and citrate buffer, pH 4.6

(12.5 ml./100 ml.). Cultures were prepared by inoculating from stock cultures and passage through two transfers in this medium for 18 hours. Two litres of this medium after sterilisation were seeded with 100 ml. of active cells obtained from the second transfer and subjected to mild aeration under aseptic conditions for 18 hours. The cells were then harvested by centrifuging and washed twice with cold distilled water. The cells were frozen in a refrigerator for 40-60 minutes and then suspended in cold distilled water to give approximately 20 mg. dry weight per ml. and used for studying the decarboxylase activity. The reaction mixture used for testing the decarboxylase activity consisted of 0.5 ml. glutamic acid (50  $\mu$ M), 1 ml. of cell suspension (20 mg. dry cells) and made up to 2.5 ml. with M/15 phosphate buffer. The activity of the enzyme, glutamic acid decarboxylase, was determined by circular paper chromatography technique which has been successfully applied for studying transaminase systems.<sup>5</sup> The reaction mixtures were incubated for 18 hours at 37°C. The colour intensities of glutamic acid as well as  $\gamma$ -amino-butyric acid bands separated on the chromatograms were measured in a Klett-Summerson Colorimeter according to the procedure described by Giri et al.<sup>6</sup> The cell suspension showed maximum decarboxylase activity at pH 4.5. The occurrence of the enzyme in yeast suggests the possibility of the formation of  $\gamma$ -amino butyric acid in yeast by enzymic decarboxylation of glutamic acid. Further work on the purification and characteristics of this enzyme is in progress.

Dept. of Biochemistry, P. R. KRISHNASWAMY.  
Indian Inst. of Science, K. V. GIRI.  
Bangalore-3,

February 26, 1953.

\* Composed of  $\text{KH}_2\text{PO}_4$  - 4.4 g.,  $\text{KCl}$  - 3.4 g.,  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$  - 1.0 g.,  $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$  - 1.0 g.,  $\text{MnSO}_4$ ,  $\text{FeCl}_3$ ,  $\text{H}_3\text{BO}_3$  - 20.0 mg. each,  $\text{ZnSO}_4$ ,  $\text{FeCl}_2$  - 8 mg. each,  $\text{CuSO}_4$  and  $\text{KI}$  - 0.8 mg. each per litre of the solution.

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### MERCUROCHROME AS A HISTOLOGICAL STAIN

A COMBINATION of haematoxylin and mercurochrome has been found successful for the double-staining of animal tissues or sections. The latter chemical disodium-hydroxymercuridibromfluorescein, the disodium salt of 2, 7-dibromo-4-hydroxymercurifluorescein, containing 24 per cent. mercury and 18 per cent. bromine is also known as merbromin-( $C_{20}H_8O_6Br_2Na_2Hg$ ). M.Wt. 750·7. A 1 or 2 per cent. solution of mercurochrome in distilled water gives satisfactory results and is easier to work with, than carmine or eosin; and the chances of over or understaining (a phenomenon of common occurrence) are very much reduced. After the sections have been stained with haematoxylin and washed, they are kept in the mercurochrome solution for three to five minutes and differentiated in running water. For mounting pure glycerine should not be used as mercurochrome tends to fade in it; but it keeps well in 25 to 30 per cent. solution of glycerine, which may be used as a temporary mounting medium for this stain.

For permanent mounting it is an ideal stain. Xylol adds to its brilliance after dehydration and the permanent preparations keep well for years without fading. Sections stained in 1945 are still as good as they were in the beginning. It has been tried on various animal tissues. In the heart of *Rana tigrina* it stained the truncus arteriosus brick-red, the lining of the valves deep pink with a slight tinge of violet due to haematoxylin, and the muscular fibres dull red. The ova of earthworm are stained lilac scarlet and the surrounding tissue very deep pink. The trachea of the cockroach bright red, and its salivary glands and the striped muscle fibres crimson red, the striations in the latter case become very distinct. I am using mercurochrome (May & Baker) as a stain for the last seven years in my classes and it has always given very satisfactory results.

I am thankful to Prof. K. Ramamurti of Birla College for the valuable information about the chemistry of mercurochrome.

Birla College,  
Pilani (Rajasthan),  
February 21, 1953.

H. L. SHARMA.

### AN ATTEMPT TO PURIFY INSULIN BY CHROMATOGRAPHY

DURING some work on insulin it appeared to us that the acetone extract of the precipitated picrates as obtained in the method of Dodds

and Dickens,<sup>1</sup> which is presumed to contain only insulin picrate, may be tested for its homogeneity by chromatographic adsorption. Various adsorbents were used for this purpose, e.g., alumina activated by heating for 2 hours at 200°C. in an atmosphere of CO<sub>2</sub>, as also the partially deactivated alumina obtained by the treatment of the activated one with alcohol; magnesia in the activated form (heating for 2-3 hours in a closed crucible with a burner), alone as well as in admixture with (i) activated alumina, (ii) sodium silicate, and (iii) sodium carbonate; the last two were not activated. The solvent used was acetone and the development of the chromatogram was effected, in each case, by washing first with a little acetone and then with a large quantity of it and finally with acetone-alcohol mixture.

The results indicate that the acetone extract of the total picrates obtained in the method of Dodds and Dickens, is not homogeneous as shown by the appearance of more than one band (generally three) when about 50 ml. of a 0·35 per cent. solution of insulin picrate in acetone is subjected to chromatographic adsorption.

The best results were observed in the case of activated alumina. The order, colour and the approximate width of the bands were 1·0-1·5 mm. (dirty-yellow to brown); 1·0-1·5 cm. (golden yellow); 0·7-1·0 cm. (colourless), and 1·0-1·5 cm. (light yellow). After keeping overnight this chromatogram appears as 1·0-2·0 mm. (brown or dirty yellow); 0·8-1·0 cm. (dirty white); 1·0-1·5 cm. (golden yellow), and 1·0-1·5 cm. (light yellow). Partially deactivated alumina gave more or less the same chromatogram as the activated one but the separation of the bands was not as well defined and the colour of the second band was light orange.

Elution experiments with water and acidic alcohol have tentatively confirmed that in these chromatograms, insulin picrate forms the middle band, generally golden yellow in colour. It was noted that by adding an aqueous solution of picric acid to the fully developed chromatogram, the lowest band quickly started diffusing downwards changing its colour to deep orange. There occurs a slight decrease in the width of the middle band by this treatment. Insulin picrate forming the middle band can be eluted by means of acidic alcohol and the hydrochloride precipitated by adding a large volume of acetone.

Since further work could not be done, it is considered desirable to send this preliminary note which might help the workers in this field.

The authors wish to record their thanks to Dr. (Mrs.) P. A. Rao for her kind interest in this work.

Chemistry Dept., AZIZUR RAHMAN.  
Muslim University, (MISS) FATIMA MINHAJ,  
Aligarh,  
March 2, 1953.

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#### SULPHATE-REDUCING ORGANISMS IN THE SOILS OF RANN AREAS IN CUTCH

IN the course of soil survey work in Cutch, some soil profiles were examined in the tertiary alluvial areas of the mainland and in the recent alluvial areas of Little and Great Ranns of Cutch. Under the arid climate of Cutch, short seasonal grasses cover the grey soils of tertiary alluvium and generally the surface drainage is good. The Rann areas are devoid of any vegetation and remain under water for nearly six months in the year. Satyanarayana<sup>1</sup> described the general conditions prevailing in the area and the characteristics of the soils. These highly saline soil profiles exhibit zones of gypsum deposition, accumulation of iron in streaks and bands, and blue-green gley horizons. These characteristics suggested that anaerobic micro-organisms are possibly responsible for the changes taking place in the soils. Iya and Sreenivasaya<sup>3</sup> have reported and studied the sulphate reducing organisms (*Vibrio desulphuricans* Konae) in the east coast soils of India. Datta,<sup>1,2</sup> isolated an anaerobic organism which reduced sulphate to elemental sulphur. It was thought fit to investigate the distribution and activity of anaerobic bacteria and particularly of sulphate-reducing organisms in Cutch soils.

A large number of soil samples were examined by seeding 1 g. of soil to 50 c.c. of van Delden's solution in 200 c.c. conical flasks. The flasks were kept under anaerobic conditions and the extent of H<sub>2</sub>S production was noted by the blackening of the lead-acetate paper, attached to the cotton plug of the flasks.

Sulphate-reducing organisms were present in all the profiles but their activity was not uniform in the different horizons of the same profile. A high activity was noticed in 3"-15" layer of soils from the Rann area. In the deep gley horizon (66"-70") intense activity was

noticed while in a profile with a surface gley horizon (12"-33") the activity was negligible. Gypsum-bearing horizons showed high activity in some profiles and negligible activity in others. Similarly, in the iron accumulation layers (incipient iron pan formation) also the activity was not consistently of the same order. An interesting observation was that the mainland soils showed the presence of sulphate-reducing organisms, the activity being high in surface soils in one area and in the other, bottom layers showing the high activity.

An examination of some of the Indian soils of non-marine areas revealed the presence of sulphate-reducing organisms as judged by the production of H<sub>2</sub>S under anaerobic condition. The sulphate-reducing organism in the Cutch soils was isolated and found to be a rod-shaped motile spore former, differing in many respects from the organisms described by other workers. A detailed study of this organism and its role in soil development processes will be published elsewhere.

K. V. S. SATYANARAYANA.  
S. C. DATTA.

Indian Agric. Res. Inst.,  
New Delhi,  
March 17, 1953.

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#### SYNTHESIS OF PECTIC SUBSTANCES IN THE POST-HARVEST CONDITION OF PEARS

WITH the abscission of fruit from the tree, the metabolism of fruits is more of the catabolic type, especially if the fruit has passed its climacteric stage. However, changes in certain chemical constituents of the fruits have been observed to be of the anabolic type. Carrel<sup>1</sup> has shown in her work on storage of apples that the total pectin content of apples tends to increase as the fruits ripen. Haller's<sup>2</sup> studies show similar trends. Heinze and Appleman<sup>3</sup> found that in sweet potatoes protopectin increased, while pectin decreased during the storage period. The increase in protopectin was partly due to an increase in the total pectic substances. Data from other sources<sup>4,5</sup> show that the concentration of sucrose and protein increases during storage of deciduous fruits.

As a part of the cold storage investigations on three varieties of pears, pectic changes during

the full storage period were studied at monthly intervals. Estimation of pectic substances was done according to the method of Carre.<sup>6</sup> The results of these studies are given in Table I. The results show that the amounts of both protopectin and total pectin increased during storage in all these three varieties suggesting that the pectic substances are synthesized during the post-climacteric period. Complete data on the pectic changes during storage at 30°-31°F. and periodical ripening at 68°-70°F. are being reported elsewhere.

TABLE I  
*Pectic changes in pears during cold storage*  
Pectic material weighed as calcium pectate and  
expressed as per cent. of fresh weight

Variety	Month	Pectin	Control	Air Filtered	Room
			Room	protopec-	Protopectin
<i>Bartlett</i>	October	0.307	0.377	0.216	0.529
	November	.202	.509	.210	.490
	December	.237	.651	.282	.620
	January	.257	.425	.310	.484
	February	.216	.481	.159	.444
<i>Bosc</i>	October	0.207	0.281	0.209	0.373
	November	.291	.399	.248	.405
	December	.221	.480	.225	.432
	January	.157	.559	.193	.555
	February	.222	.543	.219	.519
<i>Anjou</i>	October	0.296	0.473	0.169	0.528
	November	.202	.431	.254	.469
	December	.172	.690	.184	.646
	January	.191	.742	.181	.677
	February	.232	.473	.118	.630
	March	.361	.448	.208	.569

\* This room was fitted up with a Dorex Unit to filter ethylene from the storage atmosphere.

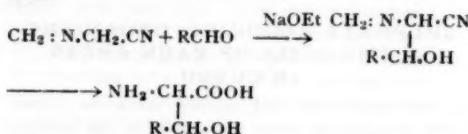
Dept. of Horticulture, W. B. DATE,<sup>‡</sup>  
Oregon State College, ELMER HANSEN,  
Cornvallis Oreg., U.S.A.  
March 3, 1953.

‡ Present Address Central Food Technological Research Institute, Mysore.

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### A NEW METHOD FOR THE SYNTHESIS OF AMINO-ACIDS AND RELATED COMPOUNDS

METHYLENE amino aceto nitrile,<sup>1,2</sup> has been found to be a convenient starting material for the synthesis of amino acids. It has been condensed with aliphatic and aromatic aldehydes in presence of sodium ethoxide when it was found to give aldol condensation products in good yields. These, on hydrolysis with hydrochloric acid, yielded the corresponding amino acids.



3.4 g. of methylene amino aceto nitrile with paraformaldehyde (7 g.) in presence of sodium ethoxide from sodium (1.15 g.) gave 2.5 g. of the intermediate aldol, whence 2.0 g. of serine was obtained after hydrolysis. Similarly, 3.4 g. of methylene amino aceto nitrile gave with paraldehyde (7.0 g.) and sodium ethoxide from sodium (1.15 g.), 3.0 g. of the intermediate and 2.5 g. of the amino acid. The yields from anisaldehyde and piperonal were 3.5 g. of the intermediate in the case of the former and 4.0 g. in the case of the latter using 3.4 g. of methylene amino aceto nitrile. The yields of the respective amino acids were 2.3 g. and 3.7 g.

The table below gives the melting points of the intermediate and final products.

Starting substance	Intermediate aldol m.p. °C.	Amino acid m.p. °C.
Paraformaldehyde	62-64	246 (decomp.) serine
Paraldehyde	..	228-29 (decomp.) Threonine
β-Anisaldehyde	125-26	155
Piperonal	218-20	125-27

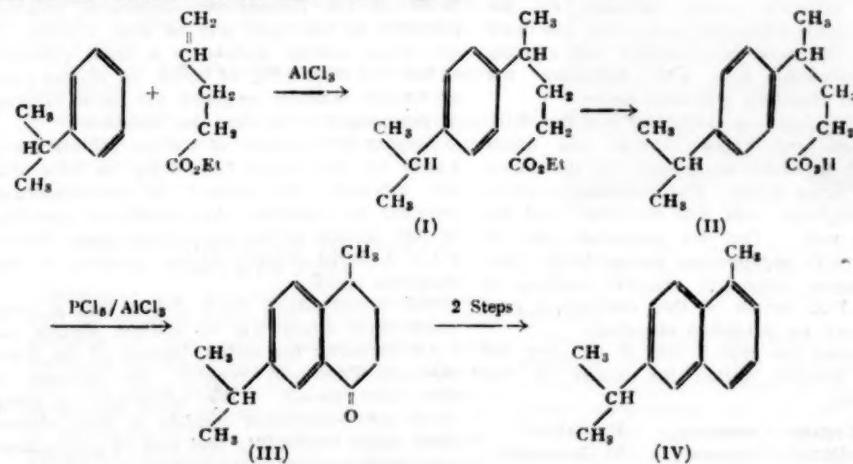
Further work is in progress and will be published elsewhere.

Organic Chemistry Dept., P. B. MAHAJANI.  
Institute of Science, J. N. RAY.  
Bombay,  
March 19, 1953.

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**FRIEDEL-CRAFTS REACTION  
BETWEEN ETHYL ALLYLACETATE  
AND CUMENE**

In an earlier communication<sup>1</sup> we reported the aluminium chloride-catalysed condensation between toluene and ethyl allylacetate and the meta orientation in the resulting product was unequivocally established. The meta orientation in the case of toluene prompted us to study aluminium chloride-catalysed reaction between cumene and ethyl allylacetate which was expected by analogy to give rise to ethyl  $\gamma$ -(*m*-cumyl)-valerate, an important intermediate in the synthesis of eudalene. In view of a recent article by Chaudhuri,<sup>2</sup> we place on record the results so far obtained in this regard.



Cumene and ethyl allylacetate were subjected to aluminium chloride-catalysed reaction at 0–5° when *inter alia* the ester (I) was obtained in satisfactory yield, b.p. 160°/10 mm. The ester (I) on hydrolysis with ethanolic caustic potash gave the corresponding acid (II), b.p. 164°/5 mm. [lit. (4) records for  $\gamma$ -(*p*-cumyl)-valeric acid, b.p. 190°–91°/10 mm.], *s*-benzyl-isothiuronium salt, m.p. 125° (Calc. for  $C_{22}H_{30}O_2N_2S : N$ , 7.25; Found: N, 7.49). Cyclisation of the above acid (II) was effected by Johnson's inverse cyclisation process<sup>3</sup> to afford the ketone (III), b.p. 146°/10 mm.; 2, 4-dinitrophenyl-hydrazone, m.p. 146°–47° (Calc. for  $C_{20}H_{22}O_4N_4 : N$ , 14.65; Found: N, 14.50); semicarbazone, m.p. 175°–76° decom. [lit. (4) records for semicarbazone of 4-methyl-7-isopropyl-1-tetralone, m.p. 175°–76° decom.], (Calculated for  $C_{15}H_{22}ON_3 : N$ , 16.21; Found: N, 16.60). It appears, there-

fore, that the fraction (I) is *para*-orientated. However, the ketone (III) was reduced (Clemmensen) and the reduced product dehydrogenated with sulphur to 1-methyl-6-isopropyl-naphthalene (IV), b.p. 130°/8 mm.; picrate, orange-red needles from ethanol, m.p. 148°. The Friedel-Crafts condensation product consisted of other fractions in addition to (I). These fractions are being studied.

Microanalyses by Drs. Weiler and Strauss, Oxford.

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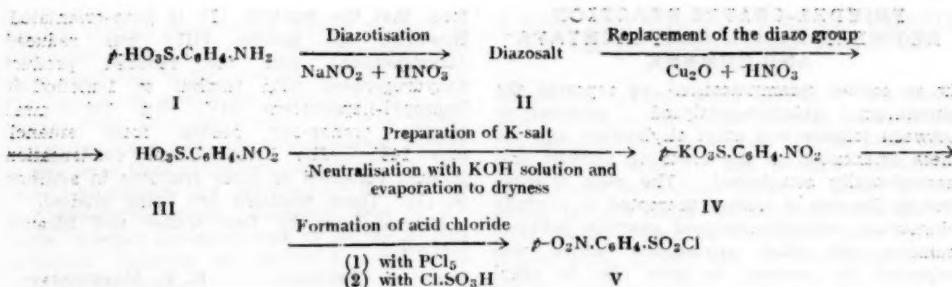
S. M. MUKHERJI.

March 24, 1953.

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**A NEW SYNTHESIS OF *p*-NITRO-BENZENE SULPHONYL CHLORIDE**

THOUGH methods of preparation<sup>1–6</sup> of this compound are to be found in literature, the product got from these is not pure as it is contaminated with large amounts of impurities [like bis (*p*-nitrophenyl) sulfoxide, bis (*p*-nitrophenyl) sulphone and *p*-nitrobenzene sulphenyl chloride] which make purification of the sulphonyl chloride difficult. Complete purification could not be effected by crystallisation. Distillation of the compound results



in explosion even if carried out with utmost care.

A new method of synthesis of *p*-nitrobenzene sulphonyl chloride which obviates all the aforementioned difficulties and yields the pure compound has now been carried out starting from sulphanic acid and following the sequence of reactions indicated above.

Sulphamic acid was diazotised and the diazo salt treated with cuprous oxide and dilute nitric acid in order to replace the diazonium group by nitro group. The resulting *p*-nitrobenzene sulphonic acid was converted into the potassium salt. The dry potassium salt on treatment with phosphorous pentachloride gave *p*-nitrobenzene sulphonyl chloride melting at 78–79° C. Full details of this method of preparation will be published elsewhere.

Our thanks are due to Dr. B. H. Iyer for his keen interest during the course of this investigation.

Dept. of Organic Chemistry,  
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March 25, 1953.

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M. RAGHAVAN.

- 
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- 

#### SUBSTITUTES FOR THE ZIMMERMANN-REINHARDT REAGENT

THE use of the Zimmermann-Reinhardt reagent in the permanganometric titration of ferrous iron in hydrochloric acid is well known.

It has been found that addition of either sodium acetate or borax instead of the above reagent in the titration yielded results precisely similar to it.

Using decinormal solutions of ferrous ammonium sulphate and potassium permanganate, in presence of 5 N hydrochloric acid, either with 30 ml. of the Zimmermann-Reinhardt reagent prepared in the usual way or with a pinch of crystalline sodium acetate or a small quantity of not less than 0.2 g. of borax, an aliquot part of ferrous solution required the same volume of permanganate solution for titration.

Varying the amount of sodium acetate from 2 g. to 6 g. and borax from 0.4 g. to 1.6 g. did not influence the amount of permanganate required for titration. An insufficient quantity of the acetate below 2 g. or of borax below 0.4 g. required slightly higher quantity of the oxidising agent.

Our investigations have shown that if only more than either 2 g. of sodium acetate or 0.4 g. of borax are added, instead of the Zimmermann-Reinhardt reagent, the purpose is very well served. The advantage of using these new substitutes consists in their cheapness, ready availability and ease of preparation compared with the older one, one of whose constituents is the costly syrupy phosphoric acid.

The change in colour at the end-point, either with the sodium acetate or borax was as sharp as in the case of methyl orange, the change from yellow to orange red lasting for not less than 1½ minutes unlike with the Zimmermann-Reinhardt reagent wherein the pink colour does not last for more than ½ minute.

In an extensive investigation on the mechanism of action of the Zimmermann-Reinhardt reagent or sodium acetate, we have observed that the pH, as determined by the Cambridge pH meter using a gold electrode with quinhydrone in the solution and a saturated calomel electrode in conjunction, goes on varying slightly with the progress of the titration and remains more or less constant at the end-point, unlike with hydrochloric acid done without any of these reagents, when it is found to fluctuate.

A study of the oxidation potentials of the whole system during the permanganometric titration of ferrous iron in presence of hydrochloric acid has also been made. It is found that without the addition of any one of the reagents in hydrochloric acid solution, there is a fluctuation of the oxidation potential all through the titration as could be seen in the unsteadiness of the pointer in the Cambridge Potentiometer. When either the Zimmermann-Reinhardt reagent or sodium acetate is present, a steady reading could be got after the addition of every ml. of permanganate solution up to the end point, after which there was inconsistency again.

Also, it has been observed that addition of sodium acetate halfway in the titration has a steady effect on the oxidation potential of the system.

Details of the investigation will be published elsewhere.

Chemical Labs., C. V. SURYANARAYANA,  
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Annamalai Nagar,  
April 1, 1953.

#### NEUROSECRETION IN *IPHITA LIMBATA* STAL.

SCHARRER<sup>1,2</sup> AND HANSTROM<sup>3</sup> have pointed out that the neurosecretory cells of the insect brain situated in the pars intercerebralis, form secretory products having endocrine function and that these pass through the nervi corpora cardiaca to reach the corpora cardiaca which act as reservoirs for the neurosecretory material. Thomsen<sup>4</sup> suggests that the medial neurosecretory cells possess an over-all control of the endocrine system of insects.

Using the chrome-hæmatoxylin-phloxin staining method after Gomori, which selectively stains the neuroglandular cells of the brain, it was seen in the bug *Iphita limbata* Stal. (?) (*Pyrrhocoridae*: *Hemiptera heteroptera*) that there is a set of giant cells in the pars intercerebralis of the brain, which are secretory. These cells are the medial neurosecretory cells (Fig. 1). They contain in their cytoplasm a dense mass of blue-black granules forming the secretion product which stands out against the red of the nervous tissue stained by phloxin. The blue-black of these cells is traceable in sections of the corpora cardiaca, which are small, paired and rounded organs lying in close contact with the brain.

The neurosecretory cells of the pars intercerebralis show a dense mass of Gomori-

positive granules in the newly moulted, mating and gravid females. They are less dense in nymphal instars, and after oviposition. Such cells with Gomori-positive granules are found in the thoracic ganglia also.



FIG. 1. Median Neurosecretory cells of brain of *Iphita limbata*—Six cells with the secretion stained blue (dark) are seen in the pars intercerebralis Gomori, technique.

The cytology and physiology of these neuroglandular cells and the pars intercerebralis-cardiacum-allatum system of the insect are under investigation and the results will soon be published elsewhere. It is interesting to note that this system of the insect has been compared to the hypothalamo-hypophysial system of the vertebrates and the X organ sinus gland system of the crustaceans.

Zoology Laboratories, K. K. NAYAR.  
University College, Trivandrum,  
March 26, 1953.

1. Scharrer, B., *Anat. Rec.*, 1951, **111**, 554. 2. —, *Biol. Bull.*, 1952, **102**, 261. 3. Hanstrom, B., *Nature*, 1953, **171**, 72. 4. Thomsen, E., *J. Exp. Biol.*, 1952, **29**, 137.

#### *PHYTOPHTHORA CYPERI-BULBOSI*, SP. NOV. ON *CYPERUS BULBOSUS* VAHL.

SOON after the rains in October 1952, a leaf blight of *Cyperus bulbosus* was prevalent in Coimbatore. One or more isolated brown lesions appeared on the leaves, later followed by the withering of the leaves. Eventually, the

infection spread to other leaves and the aerial shoots dried up. The disease was caused by a species of *Phytophthora*. Both sporangia and oospores were produced on the host plant. The former developed on stalks emerging through the stomata. The oospores were formed in the tissues of the leaf-blade and sheath.

All attempts to grow the fungus on the agar media usually used for cultures of *Phytophthora* failed. Infection experiments were conducted using sporangia produced on the host leaves. Typical lesions were produced on the third day on the leaves of *C. bulbosus*.

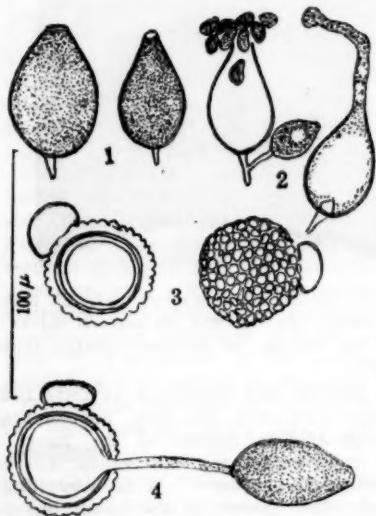


FIG. 1. Sporangia, 2. Germinating sporangia, 3. Oospores (sectional and surface views), 4. Germinating oospore.

*Phytophthora cyperi-rotundati* Saw.<sup>1</sup> has been reported on *C. rotundus* from Formosa. The fungus under study exhibits affinity to this fungus but differs from it, in its inability to infect *C. rotundus* and in the possession of tuberculate oogonia. Furthermore, the antheridia are all paragynous, while in *P. cyperi-rotundati* they are amphigynous or paragynous. On account of these differences, it is described as a new species under the name, *P. cyperi-bulbosii*.

#### *Phytophthora cyperi-bulbosii*, sp. nov.

Maculae irregulares, indefinitae, brunneae, amphigenae; hyphae intercellulares, ramosae; sporangiophori emergentes per stomata, haud ramosi, vel sympodiae ramosi, tenues; sporangia

obpyriformia, papilla lata,  $40 \times 25 \mu$  ( $23-50 \times 20-34$ ), germinantia per productionem zoosporarum vel tuborum germinationis; oogonia efformantia in cavitibus aeries in vagina foliorum, sphaerica, reticulata, parietibus crassis, fuscæ brunnea,  $40 \mu$  (31-53) diam.; oospore fere impletæ oogonium, sphaericæ, levibus parietibus ornatae, brunneæ  $33 \mu$  (25-42) diam.; antheridium ut plurimum unum in singulis oogoniis, paragynum  $16 \times 12 \mu$  hyalinum; oospore germinantes in maturitate, producentes unum sporangium in apice tubuli germinationis.

On living leaves and leaf-sheath of *Cyperus bulbosus* Vahl. (Cyperaceæ), Coimbatore, 10-11-1952, Kumari V. Seethalakshmi.

We are indebted to Dr. H. Santhapau for the Latin translation.

Agric. Col. & Res. Inst., V. SEETHALAKSHMI.  
Lawley Road, P.O., T. S. RAMAKRISHNAN.  
Coimbatore,  
December 18, 1952.

1. Ito, S., et Tokunaga, Y., *Trans. Sapporo Nat. Hist. Soc.*, 14, 14.

#### MORPHOLOGY OF THE SPOROCARP IN THE MARSILEACEAE

THE morphological nature of the sporocarp of Marsileaceæ has long remained controversial. While it is generally agreed that it is a foliar structure, opinion is sharply divided as to the number, structure and nature of segments entering into its composition. None of the existing views seems to stand a critical examination.

During the course of our study of the anatomy of the sporocarp of *Marsilea minuta* L., though nothing strikingly different from what has already been described could be observed, it was nevertheless realized that in the vascular plan of the sporocarp there are features whose significance has not been fully appreciated so far. A brief account of these may be helpful at this stage.

Each sporocarp receives one median bundle which, towards the distal end, splits up into two branches. From this, about ten commissural bundles are set off alternately on each side (Fig. 1). They encircle down the wall of the sporocarp and break up into three branches each after traversing about one-third of their total distance. The two outer bundles diverge sideways into the inter-soral area of the wall of the sporocarp. In the lower region, each of these fuses with a corresponding branch from the adjoining commissural bundle. The third

branch diverges inward and supplies the sorus which occurs in the plane of the commissural bundle. Just before bending down, it gives off a small branch for the upward extension of the sorus in the opposite direction (Fig. 1).

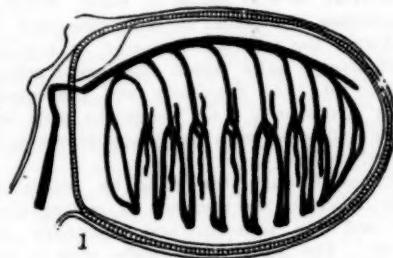


FIG. 1. Diagrammatic representation of vascular plan of one half of the sporocarp of *M. minuta* as seen from inside. Thick lines denote vascular bundles.

We believe that these anatomical features are of special interest in reading the past history of the sporocarp.

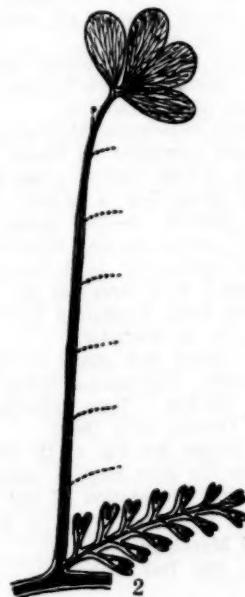


FIG. 2. Schematic representation of the authors' conception of a primitive leaf of *Marsilea*. The lowest leaflet is fertile with lobed pinnules. It is believed that the present-day sporocarp is obtained from such a leaflet by fusion and enfolding of its pinnules.

It is generally agreed that the primitive leaf of the Marsileaceae had many leaflets, all

arranged on one side<sup>1,2</sup> on an anadromic helicoid plan such as is seen in the leaf of *Pteris semipinnata*. Generally, two of these have survived, the lowest forming the sporocarp and the uppermost developing into vegetative segments (whether these vegetative segments are leaflets or pinnules is discussed in the fuller account elsewhere). The suggestion made by some authors that sporocarp consists of two or four leaflets is, therefore, based on misconception (see Fig. 2). It must always be equivalent to a single leaflet.

The past history of the fertile leaflet (sporocarp), however, has been most controversial. We think it is very clearly illustrated in the vascular plan of the sporocarp. Each fertile leaflet consisted of as many pinnules as the number of commissural bundles, the latter forming the mid-rib bundles of the former. Every pinnule was bilobed and bore sporangia on the inner margins of its lobes (Fig. 2). In course of evolution, all the lobes and pinnules fused together and all the sporangia stood up borne on a ridge, the placental ridge, which perhaps secondarily extended upward beyond the point of origin of the placental bundle. That this may have been so is borne out by the condition in the less specialized *Regnellidium* where there is no such extension.<sup>3</sup> Ultimately, the enfolding and subsequent fusion of the lamina resulted in a globular sporocarp. That such has been the course of events in the evolution of this complex fruiting body seems to be clearly indicated by the behaviour of the commissural bundles and their branches. The bilobed condition of the fertile pinnules, which is suggested by the forking of the commissural bundles and which is an essential feature of the interpretation put forward here, offers a satisfactory explanation of the location of the sorus opposite to the mid-rib bundle of the pinnule. This fact has not been adequately explained in any of the interpretations so far suggested.

The direction of the folding of the pinnules, whether abaxial or adaxial, has also been very controversial.<sup>2</sup> We have observed that the main bundle in the rachis, peduncle and the sporocarp is more or less V-shaped with the concavity on the adaxial side. Since in the sporocarp this concavity is on the inner side, it is concluded that the folding is adaxial.

Thus, there are three important features which are brought to light by the present study: (1) the pinnate nature of the single fertile leaflet which forms the sporocarp, (2) the bilobed nature of the fertile pinnules,

and (3) the adaxial folding of the pinnules. All these are of special value for a thorough understanding of the morphology of the sporocarp in the Marsileaceae.

Dept. of Botany, V. PURI.  
Meerut College, MAN MOHAN LAL GARG.  
Meerut, India,  
January 9, 1953.

1. Bower, F. O., *The Ferns II*, 1226. 2. Eames, A. J., *Morphology of Vascular Plants, Lower Groups*, 1936. 3. Johnson, D. S. and Chrysler, M. A., *Amer. J. Bot.*, 1938, **25**, 141-56.

#### INFLUENCE OF DEPTH OF FURROWS IN THE IRRIGATION OF POTATOES

THE experiment was conducted to find out under Delhi conditions, the optimum amount of water required to mature the potato crop and give the most economic return of tubers. The treatments were (1) Irrigation : 5, 7 & 9 each of 3" depth. (2) Depth of furrows 4½", 6" and 9". (3) Nitrogenous fertilizers 40, 80 and 120 lb. N/acre. The layout was of  $3 \times 3 \times 3$  partially confounded design with two replications having 3 blocks in each. Each block had 9 plots and each plot was of 24'  $\times$  15', i.e., 1/121 acre in area. 2' border was kept between the plots. Irrigation water was measured with a 90° notch. The rainfall was 4.56" spread over the growing season. There was no run off. The water table fluctuated between 15' and 11' from the surface. The variety of potato was *Phulwa*.

Statistical analysis of the results showed that the differences in yield due to treatments of irrigation and depths of furrows were significant at 1% level. In irrigation treatments there was practically no difference in yield with 21" and 27" of water but both were significantly superior to the yield obtained with 15" of water showing thereby that 21" was the optimum dose. The increase in yield due to 6" deep furrows was significantly greater at 1% level over that due to 4½" deep furrow and at 5% level over that due to 9" deep furrows. The 9" deep furrows had given significant increases in yield over that due to 4½" deep furrows at 5% level. The yield of tubers obtained with 80 lb. N/acre was greater than that obtained with 40 or 120 lb. N/acre. 6" deep furrows in combination with 21" of water or 80 lb. N/acre gave the optimum yield.

Ind. Agric. Res. Inst., N. P. DATTA.  
New Delhi, B. B. BOSE.  
February 16, 1953.

#### AN UNDESCRIPTED SPECIES OF *SYNCHYTRIUM* ON *AMPELOCISSUS LATIFOLIA*

ON *Ampelocissus latifolia* Planch., a member of the Vitaceae, a *Synchytrium* species was collected from several places in Bihar, which on examination was found to be undescribed. On the leaves the infection appeared as tiny yellowish minute galls, which often were grouped together in close proximity and presented a scabby appearance. On stems the galls were minute and imparted a warty appearance to the infected regions.

Sections through the galls on leaves and stems indicated the presence of resting spores only and the prosorus and sporangia were absent. The galls were single with a large reddish-brown resting spore in each. The epidermal host cells surrounding the infected epidermal cell multiplied rapidly and produced a mass of hyperplastic tissue which surrounded the gall. Consequently in the sections through the gall, the resting spore was seen embedded in a small mound of hyaline cells. In old galls the resting spores dropped off leaving a large concavity in the centre.

Comparative studies indicated that it differs from other species of *Synchytrium* known on Vitaceae and related families.

*Synchytrium ampelocissi* Mishra sp. nov.

Inciting gall formation on leaves and stems ; galls minute, golden yellow, often grouped together and presenting a scabby appearance, simple and distinct. Resting spores globoid to subspherical, golden-brown, thick-walled with oil globules surrounded by a mound of thin-walled tissue, 2 to 3 layers at top and 2 to 4 layers on the sides, measuring 110.4 to 220.8  $\mu$  average 141.4  $\mu$  in diameter.

Hab. On leaves and stems of *Ampelocissus latifolia* Planch., Darbhanga, Bihar, 7-12-1952. leg. J. N. Mishra. Type deposited in Herb. Crypt. Ind. Orient., New Delhi.

Grateful thanks are due to Dr. M. J. Thirumalachar for his kind help in identification of the fungus and preparation of the manuscript.

Div. of Plant Pathology J. N. MISHRA.  
and Mycology,

Bihar Agric. Res. Inst., Sabour,  
Bhagalpur,  
February 13, 1953.

#### EGG-YOLK FACTOR AS BUFFALO SEMEN DILUTOR

It has been shown that the fertilizing capacity or the motility of buffalo spermatozoa cannot

be retained on an average for more than 48-72 hours in either egg-yolk phosphate or citrate buffer dilutors, which have proved so useful and popular for *Bos taurus* and *Bos indicus* semen. This has been a limiting factor in the wider application of artificial insemination in buffalo.

Experiments recently started with the active principle<sup>1</sup> present in egg-yolk have given encouraging results. The active principle was isolated by first precipitating proteins in egg-yolk with the addition of 4 vols. of acetone and subsequent washing with acetone to remove the greater proportions of the lipids. The yellowish precipitate was dried in *vacuo* to remove acetone, then extracted with Sorensen's buffer system— $\text{Na}_2\text{HPO}_4 + \text{KH}_2\text{PO}_4$  (pH 7.4) and followed by filtration or centrifuging of the buffer extract to remove insoluble material.

Fifteen good quality ejaculates from eight different buffalo bulls, belonging to a breed indigenous to Uttar Pradesh, were preserved at 4°C. in the solution of the active principle in the ratio of 1:1. Samples taken from the same ejaculates and kept in egg-yolk phosphate buffer dilutors served as controls. In the majority of cases, two samples of each ejaculate were preserved in each dilutor. In the controls no sperm survived beyond 12 days while in the samples preserved in the active principle live sperm were present upto 21 days. Further, in the former, out of 14 ejaculates, 5 could not be used for artificial insemination after 24 hours, 8 after 96 hours and 1 after 144 hours (having motility rating less than +++) while in the latter, 5 could be used upto 192 hours, 1 upto 240 hours, 5 upto 288 hours and 1 upto 336 hours. Only in two samples kept in the active principle was no live sperm present after 96 hours. It was also observed that the trace of lipo-protein was essential to prevent spermatozoa from the temperature shocks.<sup>2</sup> These results show that the life of the buffalo sperm *in vitro* could be extended for periods upto 2 to 3 times through the use of only the active principle in egg-yolk instead of egg-yolk itself in the dilutor. Further work is in progress.

Division of Animal Genetics, P. N. SRIVASTAVA,  
Indian Veterinary Res. Inst., S. S. PRABHU.  
Izatnagar,  
March 10, 1953.

P. BHATTACHARYA.

1. Mayer, D. T. and John, F. Lasley, *Jour. of Animal Science*, 1945, 4, 277. 2. Kampschmidt, R. F. and Mayer, D. T., *Abs. Jour. of Animal Science*, 1951, 10, 1077.

#### 'CREEPING' A MUTANT IN CAJANUS CAJAN MILLSP.

DURING the course of botanical improvement work on tur at the Agricultural Research Station, Niphad (Nasik), two unusual plants having abnormal structure and distinctly different as compared to the normal tur plants, were observed in the F-3 progeny of a cross between T. 74 and T. 43. These plants arose spontaneously and are breeding true for the last six years.

The normal tur plants grow erect, giving lateral, erect branching of indefinite or raceme type. None of the branches in normal tur plants is prostrate.



Newly observed plants have a weak stem as well as branches and hence put forth all its lateral branches close to the ground which results in a prostrate habit of growth. Because of the peculiar growth habit associated with this character, they have been named Creeping.

The creeping character had not been observed in either of the parental lines. Creeping plants are indistinguishable from the normal plants up to the time that the stem begins to elongate rapidly. Under ordinary field conditions the plants are about 1½' in height and 1½ to 2 months age at this time. As the stem and branches elongate, they lack sufficient strength to hold the plant erect and branches spread flat on the ground.

The prostrate habit is likely to be found useful as a cover crop and would help in soil conservation in the dry regions and in strip cropping.

The detailed genetical behaviour of these plants are under study and will be published later. Histology of stem of these plants is also being studied.

Agricultural Res. Station, B. B. CHAUDHARI.  
Niphad (Nasik), J. A. PATIL,  
February 11, 1953.

## REVIEWS

**Astronomy for Everyman.** Edited by Martin Davidson. (Dent & Sons., London), 1953. Pp. 512. Price 18 sh. net.

This is an up-to-date and authoritative summary of astronomical knowledge and of the methods used in acquiring the same. Besides the introduction which gives a general survey of the universe by the editor, there are 12 chapters, each written by an expert in the field—usually the Director of the Corresponding Section in the British Astronomical Association. Of these, five are devoted to the solar system, while the others deal with comets and meteors, the aurora and zodiacal light, the stars, light and instruments, history of astronomy, navigation, and the road to the planets (interplanetary flight). The treatment is popular, and mathematics has been avoided except in footnotes and appendices, and in the chapter on navigation which is intended for the special reader. There are nearly 180 figures and 40 photographic plates to illustrate the wealth of material which has been condensed into this excellent book. Among the latest advances in astronomy which find a reference in the book are the study of shortwave electromagnetic radiation from various sources, not only in the Milky Way region, but also elsewhere, new optical instruments in use in the solar observatory, the detection of meteors (which usually leave an electron trail behind them) by means of radar—a method which can be used also in daylight and has enabled streams coming from the direction of the sun to be detected. In the historical chapter, there are references to the astronomical discoveries of the Egyptians, the Chinese, the Babylonians and to Muslim Astronomy, but references to India's astronomical contributions are conspicuous by their absence.

A. NARASINGA RAO.

**Theory of Electric Polarisation.** By Dr. C. J. F. Bottcher. (Elsevier Publishing Company), 1952. (Distributors : Eleaver Hume Press Ltd., London). Pp. xii + 492. Price 70 sh.

This book gives a nearly complete survey of the theory of electric polarisation and related subjects for the use of both physicists and physical chemists. Much attention is paid to fundamental concepts and the reader is expected to be familiar with the basic principles of electrostatics and vector calculus. Four append-

dices on such mathematical subjects as the Legendre functions, and the Laplace operator have also been added. The introductory chapters deal with the definitions of fields of an ideal and a non-ideal dipole and with the fundamental concepts and problems of electrostatics such as the vectors  $E$  and  $D$ , the polarisation  $P$  and polarisability  $\alpha$ . The reaction field of a dipole is discussed in Chapter III while in Chapter IV, multipoles are discussed. In Chapter V, the various types of problems relating to polarisation and energy in a dielectric medium are discussed. Included in this chapter is a discussion on the contribution of the permanent dipoles to the cohesion energy in a fluid.

The important problem of a dielectric placed in a uniform external field is the subject-matter of Chapter VI. In the various discussions of the effective value of the external field, no reference has been made to the theory originally developed by Raman and Krishnan in 1927 for pure liquids with anisotropic molecules and later extended to the case of mixtures of dielectrics. In Chapter IX on the determination of permanent dipole moments, the several methods of measurement and computation developed hitherto have been dealt with critically, together with a brief discussion on the relation between dipole moments and molecular structure. The next chapter deals with the subjects of polarisation at high frequencies and the factors of loss angle and relaxation time. The last chapter deals with the polarisation of solids.

Taken as a whole, the book provides a comprehensive and critical account of the current theories of dielectric polarisation and is in itself a valuable addition to the contributions to the subject. The book has been clearly printed and got-up in a pleasant readable form and must be considered as a distinct success in the art of book production. M. A. G. R.

**Gravity Waves.** Edited by A. V. Austin, Director, National Bureau of Standards, U.S. Dept. of Commerce. (*N.B.S. Circular* 521, November 28, 1952). (Supdt. of Documents, U.S. Govt. Printing Office, Washington). Pp. iv + 287. Price \$ 1.75.

This volume comprising the proceedings of the N.B.S. Semi-Centennial Symposium on

Gravity Waves held at the N.B.S., June 18-20, 1951, covers a wide range of experimental and theoretical results in the study of gravity waves in U.S. and European laboratories. There are 33 papers by different authors of which 7 are in abstract only. In addition to study of sea-waves, their refraction, diffraction and breaking at harbours and breakwaters, the contributions also include papers on sub-surface flow, on atmospheric tides and on motion of water due to breaking of a dam.

Two papers, one on discrete and continuous spectra by Ursell and one on Fourier Analysis of wave trains by Birkhoff and Kolik analyse some of the characteristics of complete wave forms. There is a number of papers on the growth of complex sea-waves, of which Neumann's observations in the North Atlantic area can be specially mentioned. The progress of waves over sloping beaches as well as their breaking are also described, and excellent details of particle movement in a breaking wave are reported by Iversen from Berkeley and Mason from the Beach Erosion Board. Some recent work on wave, and seiches is reported by McKnown, and an article on tides in an enclosed basin by Zerbe describes the derivation of earth movement from observations in the David Taylor Model Basin. On measurement techniques, mention may be made of the stereophotogrammetric waves measurements by Schumacher, and the laboratory methods used at Chatou, France.

This excellent contribution on the latest researches is commended to the technical and research workers in the subject, as a valuable bridge between the purely engineering applications of gravity waves and their treatment in terms of the hydrodynamics of the classical school.

S. K. Roy.

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**The Cathode Ray Oscillograph in Industry.** By W. Wilson. Fourth Edition. (Chapman & Hall Ltd., London), 1953. Pp. 273. Price 36 sh.

The book under review covers a very important theme which has been discussed only partly in few existing books on the general application of oscilloscopes. The demand for such a book is no doubt high.

According to the preface, the author has intended, bearing in mind the interests of users, to deal with all kinds of cathode ray oscilloscopes, their construction, functioning and application. It would have been enough if the author had concentrated strictly on this theme. Instead, he has included short descriptions of

some kind of electron tubes, related devices and equipment which have been sufficiently described in available technical literature. This is especially applicable to Chapter XI, which describes the electron microscope and its applications—a subject on which there are special books.

The description of the working principles of cathode ray tubes, their parts and equipment, is too meagre for those who are unacquainted with electronic technique. The photographs of some cathode ray tubes and their parts do not give a clear impression about them and could be replaced by drawings to better advantage. The description of different types of oscilloscopes consists only of short explanations for a series of photographs and one complete diagram of a miniature oscilloscope. The special Chapter XII: "Construction, Operation and Maintenance" contains very little in spite of its importance. The contents of the book require replenishing and completion. Some small discrepancies which cannot be mentioned in this short review, should also be rectified.

The positive feature of this book includes a review of the application of oscilloscopes with glass and metal cathode ray tubes for different technical tests given in Chapters V-X, illustrated with reproductions of the photographs from the oscilloscope screen taken during the different tests. The directions regarding the operation of metal oscilloscopes given in the book are very useful.

References are given throughout the text, but it would be desirable to increase their number and collect them in a list at the end of the book.

The book will be useful for the technician, scientist and students having already some experience with electronic equipment, also as a reference book for the application of oscilloscopes for different technical tests.

A. SUSZKIN.

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**Colloid Science. Vol. I (Irreversible Systems).**

Edited by H. R. Kruyt. (Elsevier Publishing Company, Amsterdam), 1952. Pp. 368. Price 70 sh.

The treatment of the subject in this book is monographic in nature and is designed to serve the needs of research workers already in the field or those who desire to familiarise themselves with certain advancing trends in colloid science. It is based on a new classification of colloids into reversible and irreversible systems, i.e., colloid systems which can undergo phase separation reversibly or otherwise. Besides the

editor, G. H. Jonker and J. Th. G. Overbeck have made contributions to this volume.

The first chapter by Kruyt deals with the classification of colloid systems based on the size of the mono-molecular particle, states of aggregation and thermodynamics of colloid solutions. The physical, chemical and optical properties have been discussed in an elegant fashion. Overbeck described the preparation, peptization and purification of lyophobic sols both in aqueous and non-aqueous media in the second chapter. 'Optical Properties of Colloidal Solutions' by Jonker in the following chapters comprises an illuminating exposition of Tyndall effect, the theory of Raleigh and fluctuations on the scattering of light by spherical as well as non-spherical particles. The succeeding six chapters contributed by Overbeck constitute an admirable survey on the structure and kind of double layers, determination of zero-point charges and the Donnan equilibrium.

The chapter on electrokinetic phenomena will prove valuable to the colloid physical chemist, for, it touches the latest trends in electro-osmosis, streaming and migration potentials. The treatment of electrophoresis is as exhaustive as it is brief from every point of view. Interactions between colloidal particles leading to attractive and repulsive forces in the double layer have been thoroughly analysed. The last chapter on the rheology of lyophobic system contains an exhaustive survey on viscosity, dilatancy, influence of external agents on gel formation and plasticity, properties of gels and pastes, thixotropy, rheopexy, etc., with reference to colloid systems.

With excellent get-up, profuse illustrations and up-to-date references, the book, it is hoped, would be widely bought and extensively read.

M. SANTHAPPA.

**Polysaccharide Chemistry.** By Roy Lester Whistler and Charles Louis Smart. (Academic Press, Inc., New York), 1953. Pp. viii + 493. Price

In recent years, knowledge of the chemistry of carbohydrates has been vastly augmented. Within the carbohydrate group, there occurs an array of compounds known as polysaccharides possessing highly complicated chemical structure. The present monograph gives a unified account of the entire field of polysaccharide chemistry, thus presenting for the first time an easily accessible volume comprising the available knowledge of all known polysaccharides. Consequently, much hitherto unassem-

bled material is brought together and each polysaccharide is dealt with in a thorough and critical manner. Since the classification and nomenclature committees have not dealt specifically with the polysaccharide field, the authors have adopted the commonly accepted terms. The book contains references to important original papers in the field of polysaccharides. The discussion and interpretations of data are throughout presented in an authoritative manner and reflect the wide experience which the authors have had in the field. The monograph will prove highly useful both as an advanced text-book to the post-graduate student and as a book of reference to the research worker.

M. SWAMINATHAN.

#### Interscience Manuals

The Interscience Publishers, Inc., New York and London, are embarking on a new publishing venture, *The Interscience Manuals*.

These handy, low-priced volumes are primarily designed as reliable tools for laboratory procedures. Emphasizing techniques rather than theory, these manuals will furnish in a small compass of about 200 pages, a proper selection of classical and instrumental methods by following the critical recommendations of its carefully chosen authors. Particularly geared for beginners not conversant with the full scope of scientific development, they will provide sound, up-to-date guidance. Here the scientific worker is given a text which will help him to instruct his assistants. Special attention is paid to clear style and lucid presentation. Among the titles in preparation are: Chromatography, Insecticides, Lubricants, Detergents, Ion Exchange, Microfilms and Microcards and Fiber Microscopy.

**Introduction to the Theory of Stochastic Processes Depending on a Continuous Parameter.** By Henry B. Mann. National Bureau of Standards, Applied Mathematics Series 24. (Order from Government Printing Office, Washington 25, D.C.), Pp. v + 45. Price 30 cents.

Chapter 1 gives the fundamental concepts and some of the principal theorems. In Chapter 2, two processes known from the theory of Brownian motion are discussed. Chapter 3 deals with the statistical estimation of these two processes. Chapters 4 and 5 discuss differential processes. The topic of Chapter 6 is the Fourier analysis of stochastic processes.

This small volume is addressed to the educated mathematical statistician although the

author has made a real effort to develop the theory of stochastic processes with as little resort to abstract measure theory as possible. The user of time-continuous processes in the applied fields who is not interested in the methods of proof may still appreciate having a number of important definitions and results conveniently arranged in one place and with a unified terminology and notation.

**BCG Vaccination.** (*Studies by the WHO Tuberculosis Research Office, Copenhagen*). World Health Organization: Monograph Series, No. 12. Pp. 307. Price 15 sh.

The WHO Tuberculosis Research Office, in collaboration with the Danish Statens Seruminstiutut and the International Tuberculosis Campaign, undertook an intensive investigation of the basic problems of tuberculosis immunization, with special reference to BCG.

The results of the work done during the first three years of the research programme are assembled in a detailed report which has just appeared as No. 12 in the Monograph Series of the World Health Organization. This monograph is, by its unbiased observations and critical analysis, an important contribution to the understanding of the problems involved in BCG vaccination.

The investigation reported in this monograph consisted of a series of separate studies, each concerned with one or more problems regarding BCG vaccination. The subjects examined include: effects on the vaccine of long-continued storage, heat, and light; changes in the technique of intracutaneous vaccination; variations in the preparation and concentration of the vaccine; mixtures of living and dead bacilli in different proportions; and the variability of vaccines prepared by different producers.

Altogether, more than 40,000 school children in Denmark, Mexico, Egypt and India were given pre-vaccination tuberculin tests, on the basis of which some 23,000 were vaccinated. Post-vaccination examinations were carried out 2-3 months, one year, and two years later and included measurement of reactions to an intracutaneous tuberculin test, measurement of the scar at the site of vaccination and observation of the local complications of the vaccination.

Complete quantitative data for all the tests and examinations, constituting a "source book" for all workers in this field, are given in tabular form as appendices.

As pointed out in the introduction, "This report describes an adventure in international re-

search, planned to meet an international need and carried through with the help of health authorities, doctors, and laymen in many lands."

**Annual Report 1952, National Bureau of Standards, U.S.A.** (Order from Government Printing Office, Washington 25, D.C.). Pp. 89 + 28 Halftone illustrations. Price 30 cents.

Summarizing scientific and engineering investigations conducted by NBS during the fiscal year 1952, this booklet contains accounts of current activities as well as more detailed descriptions of representative projects.

Major fields of activity include the following: electricity, optics and metrology, heat and power, atomic and radiation physics, chemistry, mechanics, organic and fibrous materials, metallurgy, mineral products, building technology, applied mathematics, electronics, radio propagation, ordnance development, and basic instrumentation.

#### Books Received

**Statistics for the Social Sciences.** By T. G. Connolly and W. Sluckin. (Cleaver Hume Press Ltd.), 1953. Pp. vii + 154. Price 16 sh. net.

**Chemical Analysis of Industrial Solvents,** Vol. VII. By Morris B. Jacob and Leopold Soefflau. (Interscience Publication, New York), 1953. Pp. xxii + 502. Price \$ 10.00.

**Power Cables: Their Design and Installation,** Vol. I, 3rd Edition. By C. C. Barnes. (Chapman & Hall Ltd.). Pp. xv + 271. Price 35 sh. net.

**Starch and Its Derivatives,** Vol. I, 3rd Edition. By J. A. Radley. (Chapman & Hall, Ltd.). Pp. xi + 510. Price 65 sh. net.

**Fatigue of Metals.** By Cazaud. (Chapman & Hall Ltd.), 1953. Pp. xiv + 334. Price 60 sh. net.

**The Annual Report of the Sugar Breeding Institute, Coimbatore.** (Published by the Order of the Government of India, Ministry of Food and Agriculture, New Delhi), 1950-51 and 1951-52.

**Survey of Biological Progress.** Edited by George S. Avery Jr. (Academic Press Inc. Publishers, New York), 1952. Pp. vii + 333. Price \$ 7.00.

**Epidemiology and Control of Endemic Syphilis.** By E. I. Grin. (World Health Organization, Monograph Series, Geneva), 1953. Pp. 93. Price \$ 1.00.

## SCIENCE NOTES AND NEWS

### Norwegian Technical Aid to India

The Norwegian Technical Aid Programme is being concentrated in two small fishing communities in the Travancore-Cochin State in South-West India. The Norwegian Parliament has already made a grant to finance the programme, and the campaign has been launched to raise another £ 500,000 by voluntary contributions from all over Norway. Norwegian experts are now arriving in India to implement the programme which is aimed at raising the efficiency of the fishing fleet, by mechanising the boats and introducing new techniques, and increasing the value of the catch by the establishment of processing and refrigerating plants. Also, health standards will be raised, and particular importance is attached to providing the inhabitants with a pure water-supply.

### International Association of University Professors and Lecturers

More than 120 delegates from 32 different countries attended the Seventh General Meeting of the International Association of University Professors and Lecturers at Amsterdam. Among the items of discussion during the four days of the meeting were such points as "Scientific Research in Industry and at the Universities", "Academic Liberty", "The Status and Salary of the University Tutor", "The Exchange of University Personnel" and "Equality of University Degrees".

### Union Catalogue of Medical Periodicals in Indian Libraries

The catalogue is a revised edition of the consolidated catalogue published by the Directorate-General of Health Services, Government of India, as Vols. I-II in 1948-49. It is hoped that this catalogue will go a long way to help the medical research workers of the country to ascertain from what source particular references will be available which may be required in connection with their work. The volumes can be had on loan by medical research workers on an application to the head of the institution concerned under rules and regulations in force at the time.

### Rubber Research Institute Publication

The Rubber Research Institute of Malaya have prepared a comprehensive leaflet listing

all their publications of current interest, with revised prices. A copy of *Publications of the RRI* may be obtained free by writing to the Director, Rubber Research Institute of Malaya, P.O. Box 150, Kuala Lumpur, Malaya.

### World List of Plant Breeders

The FAO has published a Supplement to the *List of Plant Breeders in Canada and the U.S.A.*, published in 1949. These two lists, together contain the names and addresses of about 2,100 breeders in 49 countries and territories, as well as information on the crops with which they work. A copy of the list may be obtained free of charge by professional plant breeders on application to the Plant Production Branch, FAO, Rome, Italy, and the request should be accompanied by the name of the plant breeder, official address, crops with which breeding work is in progress and line of research.

### Belgian Chemical Directory

The Fédération des Industries Chimiques de Belgique has published a 1953 edition of its Directory.

This work, which gives interesting information about Belgian chemical industry, is divided into the following sections:

Organization of the Federation; List of the Members of the Federation, with details of addresses; List of the products made and sold by the Members; List of the Laboratories affiliated; List of the Sales Organizations; Alphabetic Index, in English, Dutch, Spanish and German; and List of Trade Marks.

The volume (492 pages) is bound in brown cloth and is sold at Belgian Frs. 150, plus B. Frs. 30 for postage. The address of the Federation is: rue Joseph II, 32 in Brussels.

### De-Salting Brackish Water

Under the auspices of the O.E.E.C., a working party was set up last year to study the desalting of brackish water. De-salting is a worldwide problem and concerns many countries where water supplies are short or are likely to become so. They include the Netherlands, South Africa, the West Indies and Pakistan.

The group of experts appointed by the working party is now drawing up its report of the four processes which were considered to merit

further investigation, viz., ion-exchange, separation by freezing, electrolysis and vapour compression distillation. Waters of 1,000, 5,000 and 20,000 parts per million chloride content have been considered. After the report has been studied, the working party should be able to recommend one or more processes for co-operative development to countries of the O.E.C., including the United Kingdom. Those interested in the progress of the work on this subject should apply to D.S.I.R., Charles House, 5-11, Regent Street, London, S.W. 1.

#### 8th International Congress of Botany

The Congress will be held in Paris from the 2nd to the 14th of July 1954. The Congress will include, besides the plenary sessions and the sessions on various subjects, chiefly sessions devoted to limited subjects of actual interest discussed in the form of symposia. All correspondence should be addressed to: Secrétaire-Général, du 8 Congress International de Botanique, 292, Rue Saint-Martin, Paris 3, France.

#### Centenary of Organotin Compounds

The first organo compound of tin was synthesised in 1852. For the past five or ten years, however, interest in these compounds has rapidly grown because some of them are outstandingly good stabilisers of polyvinyl plastics.

#### The Royal Institute of Chemistry

At the Annual General Meeting of the North India Section of the Royal Institute of Chemistry held in March 1953, the following office-bearers were elected for the year 1953-54. *Chairman*: Prof. T. R. Seshadri; *Hon. Secretary and Treasurer*: Dr. G. S. Saharia; *Hon. Auditor*: Mr. B. N. Sastri.

#### Award of Research Degree

The University of Poona has awarded the Ph.D. Degree in Chemistry to Shri. J. M. Athavale for his thesis entitled, "Synthesis in Benzopyrone Series".

#### Raptakos Medical Research Fellowships

The Raptakos Medical Research Board will consider applications for the award of Fellowships for research work on medical and allied subjects in recognized institutions situated in

the Union of India. The awards normally consist of Rs. 3,000 per year for a Fellowship and Rs. 750 per year towards special equipment or chemicals.

Each application should be accompanied by six copies of a brief statement of the research project and the comments of the guide regarding the suitability of the project and the facilities existing at the Institution. Fellows should have an M.B.B.S. or M.Sc. Degree or its equivalent or not less than two years' experience in research work after B.Sc. Applications for Grants for the year commencing 1st January 1954, should reach the Secretary, Raptakos Medical Research Board, 253, Dr. Annie Besant Road, Worli, Bombay 18, before 1st September 1953.

#### Award of Prizes, University of Madras

*The Maharaja of Travancore-Cochin Prizes for 1953-54.*—Two prizes, one in each of the following groups of subjects, will be awarded by the Syndicate for the best essay or thesis written by any graduate of the Madras University on a topic dealing with one of the subjects: (1) Botany, Zoology and Physiology; (2) Anthropology and Archaeology. Competitors should submit their theses so as to reach the Registrar not later than the 1st March 1954.

#### Control of Infections of Elderly Diabetics by Terramycin

A total of 70 diabetic patients were treated with terramycin for varied infections by Dr. Joan B. Walker, Head of the Diabetic Department of the Leicester Royal Infirmary in England. Excellent to good results were obtained in 46 out of 50 cases of infections of the feet, the most common type of diabetic infection, resulting from reduced blood circulation in that area. It was noted that, swelling and pain subsided very rapidly, with conspicuous improvement in 48 hours. Of these patients, 44 were over 60 years of age, and all but one over 50.

Because of its wide range of activity, its lack of unpleasant side-effects and its ease of administration, terramycin appears to be an efficacious and economic drug for control of crippling diabetic infections. A complete report of the studies appears in a recent issue of *The Lancet*.

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